EXHIBIT 1

IN THE UNITED STATES DISTRICT COURT
FOR THE EASTERN DISTRICT OF PENNSYLVANIA

AETNA, INC., *et al.*, **Plaintiff,** **v.** **MEDNAX, INC., *et al.*,** **Defendants.**	**Civil action** **No. 18-2217**

EXPERT REPORT

OF

JOSEPHINE I. DUH, PH.D.

CONFIDENTIAL

October 26, 2020

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I. INTRODUCTION AND QUALIFICATIONS

1. I am an economist and Senior Associate at The Brattle Group ("Brattle"), a global economics and financial consulting firm. I specialize in analyzing industry data, such as health insurance claims data, and developing econometric[1] models to assess liability and damages, particularly in the Healthcare and Life Sciences industries.

2. I have worked on numerous cases in healthcare litigation that required expertise with industry data to develop evidence. For matters of alleged anticompetitive conduct, I have used state hospital discharge data and hospital financial records to analyze market definition and market shares. I have analyzed authorization and paid and denied claims data from a large commercial health insurer to calculate avoided costs and administrative revenue associated with denials of authorization requests and/or claims. I have experience preparing and summarizing Medicare Part D, Medicaid, and TRICARE prescription claims data to calculate government spending and damages.

3. In 2017, I provided summary witness testimony for Plaintiffs in *Alexander et al. v. United Behavioral Health (3:14-cv-05337)/Wit et al. v. United Behavioral Health (3:14-cv-02346)* before the U.S. District Court in the Northern District of California San Francisco Division.

4. I also have experience leading teams on cases that required extensive econometric modeling. I have supported Professor Daniel McFadden, who won the Nobel Prize in Economics in 2000 for his contributions in econometrics, on multiple matters, including a matter that involved modeling physician prescribing behavior. I have worked closely with utility companies to develop forecasting models of electricity demand across rate classes that applied econometric modeling techniques.

5. In 2018, I was a co-winner of The Austin Robinson Memorial Prize for the "best non-solicited paper published in the *The Economic Journal* by an author who has completed

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[1] James H. Stock and Mark W. Watson, *Introduction to Econometrics Third Edition*, (Pearson, 2015), p. 3 ("At a broad level, econometrics is the science and art of using economic theory and statistical techniques to analyze economic data.").

their PhD in the last five years." *The Economic Journal* is a peer-reviewed general interest journal in the field of economics.

6. I received my Ph.D. in Economics from Princeton University and B.S. in Economics from MIT. My curriculum vitae is included as Appendix A.

7. Brattle charges $500 per hour for my services. I have been assisted by Brattle staff working at my direction. Our compensation is not contingent on my findings or on the outcomes of this proceeding.

8. In Appendix B, I have enclosed a comprehensive list of facts and data that I considered in forming my opinions.

9. I render my opinions with a reasonable degree of professional certainty. I reserve the right to update my analysis and conclusions should additional information become available prior to trial.

II. ASSIGNMENT

10. I have been asked by Counsel for Aetna Inc., Aetna Health Inc., Aetna Health, Inc., Management LLC, and Aetna Life Insurance Company (henceforth "Aetna") to apply statistical methods to address whether, between January 1, 2009 and February 27, 2019, Mednax, Inc., Pediatrix Medical Group, Inc., and Mednax Services, Inc. (henceforth "Mednax")[2] systematically billed Aetna more higher-severity evaluation and management ("E/M") codes for providing services to newborns who required more than normal[3] newborn care compared with non-Mednax providers. I understand that

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2 On June 5, 2020, Mednax announced that the company would revert to its former name "Pediatrix Medical Group." See businesswire.com, "MEDNAX Announced Significant Progress in Strategic Transformation," June 5, 2020, https://www.businesswire.com/news/home/20200605005067/en/MEDNAX-Announces-Significant-Progress-in-Strategic-Transformation (last viewed on October 4, 2020).

3 According to the American Academy of Pediatrics ("AAP"), a normal newborn is defined as "a newborn who [t]ransitions to life in the usual manner, [r]equires delivery room intervention but is normal after transition, [m]ay require some testing or monitoring (eg, bilirubin, complete blood cell count [CBC], culture), [w]ill not require significant intervention, [i]s being observed for illness but is not sick, [i]s late preterm but requires no special care, [is] in house with sick mother/twin;" see Linda D. Parsi, Cindy Hughes, and Becky Dolan, *Coding for Pediatrics 2019: A Manual for Pediatric*

Aetna alleges that, by billing higher-severity E/M codes, Mednax received higher payments from Aetna, Aetna's enrollees, and Aetna's self-insured clients during this time period.[4]

III. SUMMARY OF OPINIONS

11. To help ensure that newborns under the care of Mednax and non-Mednax providers[5] in my analysis are comparable, I focus on newborns who received newborn care services in a neonatal intensive care unit ("NICU")[6] since this is the type of care Mednax most commonly provides to newborns.[7] I apply statistical methods to assess whether Mednax billed higher-severity E/M codes[8] for newborns than non-Mednax providers in the NICU that allow me to control for potentially confounding factors that may also lead to differences in E/M newborn care services that were billed. Examples of these confounding factors[9] include differences in the birth weight and gestational age of newborns under the care of Mednax and non-Mednax providers prior to receiving care

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Documentation and Payment, American Academy of Pediatrics, 2019 ("AAP Coding for Pediatrics 2019"), p. 388.

4 Complaint, *Aetna Inc., et al. v. Mednax, Inc., et al.*, Civil No. 01040, April 25, 2018, p. 2.

5 In my report, I refer to newborns under the care of Mednax providers as "Mednax newborns" and newborns under the care of non-Mednax providers as "non-Mednax newborns." For more details on how I determine if a newborn is under the care of a Mednax or non-Mednax provider, see Section V.B below.

6 I include newborn care services provided in specialized nurseries and intensive care units, and for shorthand, I refer to them collectively as the "NICU." In terms of hospital revenue codes, specialized nurseries and intensive care units encompass 172-174 and 200-209. See Section IV.B.1 for more detail about hospital nurseries and revenue codes.

7 As examples, see Mednax, Inc. Form 10-K for fiscal year ended December 31, 2009, p. 6 and Mednax, Inc. Form 10-K for fiscal year ended December 31, 2019, p. 3.

8 I focus on E/M codes for newborn care services that are billed on a per diem basis and fall into one of four severity levels (listed in order from lowest to highest severity): newborn care, hospital care, intensive care, and critical care. "Higher-severity E/M codes" refer to intensive and critical care codes. See Section IV.B.2 for the list of E/M codes included in my analysis and descriptions from the official coding manual published by the American Medical Association ("AMA").

9 "Confounding factors" or "confounders" refer to factors that may provide an alternative explanation for the results of the analysis. In Section VII, I discuss how econometric methods can address potentially confounding factors, and in Section VIII, I demonstrate that my results withstand tests for these alternative explanations.

in the NICU.[10] These statistical methods allow me to test for systematic differences in billing between Mednax and non-Mednax providers.

12. Physician groups like Mednax receive higher reimbursements for E/M codes of higher severity, where the highest reimbursements are associated with intensive or critical care E/M codes. I find that, even after controlling for potentially confounding factors that may influence which E/M codes are billed for newborns in the NICU, newborns under Mednax's care in the NICU had a higher number of intensive or critical care codes per episode, on average, than newborns under the care of non-Mednax providers. I conduct numerous tests for alternative explanations, and I consistently find that, on average, Mednax billed a higher number of intensive or critical care codes for care in the NICU than non-Mednax providers.

13. The overall difference in the number of intensive or critical care codes billed in the NICU by Mednax relative to non-Mednax providers can be split into two components: (1) longer stays in the NICU and (2) substitution away from lower-severity E/M codes towards higher-severity E/M codes. I find that the overall difference between Mednax and non-Mednax newborns is driven by both components: newborns under the care of Mednax providers had longer stays in the NICU than newborns under the care of non-Mednax providers; and compared with non-Mednax newborns who spent the same number of days in the NICU, Mednax newborns were billed more intensive or critical care codes instead of newborn or hospital care codes. The results showing longer stays and substitution away from lower-severity E/M codes among Mednax newborns also hold up against alternative explanations, such as differences in newborn health risks.

14. Lastly, I conduct an analysis to understand when Mednax providers were billing higher-severity E/M codes instead of lower-severity E/M codes during the newborn's stay in the NICU. I find that, relative to non-Mednax newborns, Mednax newborns were more likely to have an intensive or critical care code on their first day in the NICU and less likely to have a newborn or hospital care code on their last day in the NICU.

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[10] My analysis excludes billed claims that were denied in the claims data. See Section V.A for more detail on my steps to prepare the claims data for analysis.

IV. BACKGROUND ON THE PARTIES AND NICU BILLING

15. This section provides an overview of the parties, Aetna and Mednax, and a summary of billing for neonatal care in the NICU. Specifically, I discuss NICU care and the E/M codes that providers use for billing when caring for newborns in the NICU. To illustrate how these components come together in my analysis, I present three simple examples of newborn episodes[11] in the NICU.

A. PARTIES

1. *Aetna*

16. Prior to 2018, Aetna was one of the "leading diversified health care benefits companies" in the U.S. and offered self-insured, fully insured, and administrative services only products to private and public customers.[12] Today, Aetna is a part of CVS Health Corporation, primarily in the Health Care Benefits division.[13] Between 2009 and 2018, Aetna covered approximately 148,000 to 174,000 commercially insured births per year across all 50 states, the District of Columbia, and U.S. Territories.[14] According to the Centers for Disease Control and Prevention, there were 1.56 million to 1.94 million births per year covered by private insurance from 2011 to 2018.[15] Based on

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11 In my report, I use the term "episode" or "episode of care" to refer to the newborn's hospital stay, which may include days in the NICU. For a definition of "episode" in the context of healthcare services, see University of Michigan Institute for Healthcare Policy & Innovation, "IHPI Brief: Understanding & Analyzing Episodes of Care (EoC)," August 15, 2018, https://ihpi.umich.edu/sites/default/files/0059_episodesofcare_boe_081518.pdf (last viewed on October 14, 2020) where an episode of care "begin[s] with a healthcare 'event',' such as a knee replacement surgery, and extend throughout a window of time when a patient receives healthcare services following that event."

12 Aetna Inc., Form 10-K for fiscal year ended December 31, 2010, p. 4.

13 CVS Health acquired Aetna on November 28, 2018; CVS Health Corporation, Form 10-K for fiscal year ended December 31, 2018, p. 4.

14 Calculated using Aetna's claims data (Aetna 17648_AEO_CJ31_CLMC.TXT, Aetna_17650_AEO_CJ31_MBRE.TXT, and Aetna_17651_AEO_CJ31_PRVE.TXT).

15 National Center for Health Statistics, National Vital Statistics Survey, 2011-2018, Public-use birth data files and documentation, https://www.cdc.gov/nchs/data_access/Vitalstatsonline.htm (downloaded on August 27, 2020). CDC began to report births by insurer type in 2011. In 2009 and 2010, insurer type was reported in addenda with approximately one-quarter to one-third of observations missing this information. National Center for Health Statistics, National Vital Statistics Survey, 2009-2010, Public-use birth data files and documentation, https://www.cdc.gov/nchs/data_access/Vitalstatsonline.htm (downloaded on October 10, 2020).

these statistics, around 9.2 percent of commercially insured births in the U.S. and U.S. territories between 2011 and 2018 were billed either to or through Aetna.

17. Before 2018 (when Aetna merged with CVS Health), Aetna acquired Coventry, a managed care company with a range of products including private health benefit plans, on May 7, 2013.[16] The addition of Coventry increased Aetna's members by 3.8 million, which was 17 percent of Aetna's medical membership in 2013.[17]

2. Mednax

18. Mednax is a publicly traded company that employs or is affiliated with physician groups across the U.S. In its 2019 SEC 10-K Form, Mednax described itself as a "leading provider of physician services including newborn, anesthesia, maternal-fetal, radiology and teleradiology, pediatric cardiology and other pediatric subspecialty care."[18] Mednax estimated that more than one in five neonatologists in the U.S. are either employed or affiliated with Mednax.[19] In its Business Update Presentation dated June 5, 2020, Mednax highlighted its presence in 25 percent of NICUs in the U.S. and Puerto Rico and its "significant leadership position in NICU / PICU / MFM and many Peds subspecialties."[20] The same presentation showed that its "top competitors" in women's and children's healthcare—Envision and Team Health—had approximately

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16 Aetna Inc., Form 10-K for fiscal year ended December 31, 2013, p. 1. *See also* Aetna, "Aetna Acquires Coventry Health Care, Inc.," May 7, 2013, http://www.aetna.com/about-aetna-insurance/sas/aetna-coventry-close.html (last viewed on September 5, 2020).

17 Aetna reported 22.2 million medical members in 2013; Aetna Inc., Form 10-K for fiscal year ended December 31, 2013, p. 41; 0.17 = 3.8 million / 22.2 million.

18 Mednax, Inc., Form 10-K for fiscal year ended December 31, 2019, p. 3.

19 Mednax, Raymond James & Associates' 40th Annual Institutional Investor Conference, March 4, 2019, https://mednax.gcs-web.com/presentations (last viewed on October 2, 2020), p. 7.

This percentage is similar to Mednax's estimated share of U.S. board certified or board eligible neonatal specialists that Mednax presented at the JP Morgan Healthcare Conference on January 13, 2010 (900 Pediatrix out of 4,000 U.S. Board-Certified/Board-Eligible); Mednax, JP Morgan Healthcare Conference Presentation, January 13, 2010, https://mednax.gcs-web.com/presentations (last viewed on October 3, 2020), p. 15.

20 Pediatrix Medical Group, Business Update Presentation, June 5, 2020, https://mednax.gcs-web.com/presentations (last viewed on October 2, 2020), pp. 4-5. PICU stands for pediatric intensive care unit and MFM stands for maternal and fetal medicine. Peds is short for pediatric.

40 or zero NICUs compared with Mednax's 387 NICUs.[21] The size of Mednax's network of physicians is unmatched by other physician groups.

19. Mednax has a national presence and maintained its position in its top markets throughout the period of my analysis. Between 2009 and 2020, Mednax expanded its geographic presence from 33 states and Puerto Rico to 39 states and Puerto Rico.[22] In 2006-2008, Mednax named Texas, Florida, Georgia, Arizona, and Virginia as its 5 largest state markets, comprising 56 percent of Mednax's net patient service revenue.[23] As of 2020, 10 of Mednax's top 20 markets are located in these 5 states, with 4 markets in Texas and another 3 markets in Florida.[24]

20. In June 2020, Mednax announced that it would revert to its former name Pediatrix Medical Group and "focus solely on women's and children's medical services."[25] In the same announcement, Mednax stated that it intended to sell its radiology business unit.[26]

B. NICU BILLING: THE NICU AND EVALUATION & MANAGEMENT CODES FOR NEWBORN CARE SERVICES

21. A neonate or "newborn" is defined as an individual who is 28 days or younger.[27] Most newborns are admitted to the hospital when they are born. Newborns with certain

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[21] Pediatrix Medical Group, Business Update Presentation, June 5, 2020, https://mednax.gcs-web.com/presentations (last viewed on October 2, 2020), p. 8.

[22] Mednax, Inc., Form 10-K for the fiscal year ended December 31, 2009, p. 3; Pediatrix Medical Group, Business Update Presentation, June 5, 2020, https://mednax.gcs-web.com/presentations (last viewed on October 2, 2020), p. 4.

[23] Mednax, Inc., Form 10-K for the fiscal year ended December 31, 2008, p. 39.

[24] Pediatrix Medical Group, Business Update Presentation, June 5, 2020, https://mednax.gcs-web.com/presentations (last viewed on October 2, 2020), p. 22.

[25] Samantha Liss, "After fallout with UnitedHealthcare came COVID-19. Now Mednax is rethinking its strategy.," Healthcare Dive, https://www.healthcaredive.com/news/after-fallout-with-unitedhealthcare-came-covid-19-now-mednax-is-rethinking/579461/ (last viewed on October 2, 2020).

[26] businesswire.com, "MEDNAX Announced Significant Progress in Strategic Transformation," June 5, 2020, https://www.businesswire.com/news/home/20200605005067/en/MEDNAX-Announces-Significant-Progress-in-Strategic-Transformation (last viewed on October 4, 2020).

[27] Kenneth P. Brin, ed., *CPT 2019 Professional Edition*, American Medical Association, 2018 ("CPT 2019 Professional"), p. 43 ("birth through the first 28 days"). See also National Institute of Health U.S. National Library of Medicine, Medical Encyclopedia, "Neonate,"

health risks or observed conditions may receive higher levels of care compared to newborns without these risks. These risks can include low and very low birth weight, near-term or preterm delivery, infection, respiratory distress, and major birth defects.[28]

22. Newborn care in the hospital results in two primary types of bills that are submitted for payment as claims to an insurer, such as Aetna: physician and hospital fees.[29] Physicians are typically reimbursed based on procedure codes, such as the Current Procedural Terminology ("CPT") codes, and many hospital fees are reimbursed based on revenue codes. In Sections IV.B.1 and IV.B.2 below, I summarize the relevant revenue and E/M CPT codes for my analysis of billing for newborns receiving care in the NICU. Section IV.B.3 walks through three illustrative examples of newborn episodes in the NICU to show how physician and hospital fees come together.

1. Nursery Levels in the Hospital

23. The American Academy of Pediatrics ("AAP") has periodically provided guidance to define levels of neonatal care. It has done this through issuing policy statements.[30] The four levels of neonatal nurseries are distinguished by capabilities and resource usage, and higher level units have the capabilities of the lower level plus additional resources. The four levels are:

   a. A level I (well newborn nursery) unit can "provide a basic level of care to neonates who are low risk."[31] Capabilities of level I nurseries include

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https://medlineplus.gov/ency/article/002271.htm (last viewed on October 3, 2020) ("A neonate is a baby who is 4 weeks or younger.").

28 See, e.g., AAP Coding for Pediatrics 2019, p. 466; Bernard Friedman et al., "The Use of Expensive Health Technologies in the Era of Managed Care: The Remarkable Case of Neonatal Intensive Care," Journal of Health Politics, Policy and Law 27 no. 3 (June 2002): 446-447; and Douglas Almond et al., "Estimating Marginal Returns to Medical Care: Evidence from At-Risk Newborns," *Quarterly Journal of Economics* (May 2010): 597.

29 Hospital fees are alternatively called facility charges.

30 American Academy of Pediatrics, "Policy Statement, Levels of Neonatal Care," *Pediatrics* 114 no. 5 (November 2004): 1341-1347; American Academy of Pediatrics, "Policy Statement, Levels of Neonatal Care," *Pediatrics* 130 no. 3 (September 2012): 587-597 ("AAP 2012 Policy Statement").

31 AAP 2012 Policy Statement, p. 592.

performing neonatal resuscitation at every delivery and stabilizing newborns born at 35-37 weeks.

b. A level II (special care nursery) unit can treat "stable or moderately ill newborn infants who are born at ≥32 weeks' gestation or who weigh ≥1500 g at birth with problems that are expected to resolve rapidly and who would not be anticipated to need subspecialty-level services on an urgent basis."[32]

c. A level III (NICU) unit has "continuously available personnel (neonatologists, neonatal nurses, respiratory therapists) and equipment to provide life support for as long as necessary."[33]

d. In addition to the capabilities of a level III unit, a level IV (regional NICU) unit has "considerable experience in the care of the most complex and critically ill newborn infants and should have pediatric medical and pediatric surgical specialty consultants continuously available 24 hours a day."[34]

24. Newborns who require more than well (or normal) newborn care will typically receive level II through IV nursery care, where level IV nursery care is capable of handling the most complex cases. AAP's guidance serves as the basis of levels of newborn care associated with nursery revenue codes, which are 170 through 179.[35] U.S. hospital billing guidelines state that the level of care for a newborn should be submitted to the insurer "based on the resources provided to the infant," as opposed to the overall

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32 AAP 2012 Policy Statement, pp. 592-593.

33 AAP 2012 Policy Statement, p. 593.

34 AAP 2012 Policy Statement, p. 593.

35 National Uniform Billing Committee, "Updated Guidance on Nursery Revenue Codes (017x) effective July 1, 2020," American Hospital Association, https://www.nubc.org/updated-guidance-nursery-revenue-codes-017x-effective-july-1-2020 (last viewed on October 5, 2020) ("NUBC 2020 Guidance"). See p. 9 stating that "level of care" is "…defined in the most current Policy Statement on Levels of Neonatal Care from the American Academy of Pediatrics on Levels of Neonatal Care."

170 is a general classification for nursery, and 179 represents "other nursery." Some newborns receiving specialized nursery care may also receive treatment corresponding to revenue code 175. There are 7 newborns in Aetna's data who have a claim with a 175 revenue code, and I do not include revenue code 175 in my main analysis.

certification level of the facility.[36] In other words, the revenue code observed in the claims data corresponds to the level of care that the newborn received from the hospital.

25. I include level II care in my analysis for several reasons.[37] First, level II nursery care is a higher level of care than "basic level of care"[38] for low-risk newborns, and Mednax provides services to newborns receiving level II nursery care. Second, in Aetna's claims data, I observe E/M codes across all severity levels among newborns receiving level II nursery care. Third, 27.5 percent of newborns in Aetna's data who receive levels III or IV nursery care began with level II nursery care; therefore, excluding days when the newborn received level II nursery care would omit a period when the newborn was already receiving higher levels of care. For these reasons, I include level II-IV nursery care in my analysis.[39]

26. In addition to newborns receiving level II-IV nursery care, I also consider newborns who were admitted to an ICU as designated by revenue codes 200 through 209. There are several hospitals that billed for care provided to newborns who required more than normal newborn care using ICU codes instead of codes associated with specialized nurseries or NICUs.[40] This includes some facilities where Mednax cared for the patient. Although the number of newborns impacted by the inclusion of ICU revenue codes is small, these episodes tend to be longer hospitals stays and more often impact newborns

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36 NUBC 2020 Guidance, p. 8.

37 A 2019 study analyzing neonatal intensive care among Anthem-insured newborns grouped levels II and III as intermediate care and level IV as intensive care; see David Goodman and Megan Murphy, "Anthem-Insured Birth Cohort Methods," p. 6.

38 AAP 2012 Policy Statement, p. 592.

39 To demonstrate that my results are not driven by newborns who receive level II nursery care, I replicate my analysis excluding newborns who only received level II nursery care and excluding newborns who did not initially receive level III or IV nursery care. I continue to find that Mednax newborns in the NICU had, on average, more intensive or critical care codes per episode than non-Mednax newborns in the NICU.

40 One example is Seattle Children's Hospital, where the hospital submitted NICU revenue codes in connection with 1 newborn and ICU revenue codes in connection with 123 newborns. I conduct my analysis without the inclusion of ICUs (revenue codes 200-209) and find that Mednax newborns still had, on average, a higher number of intensive or critical care codes per episode than non-Mednax newborns.

under the care of non-Mednax providers.[41] Thus, to avoid truncating the number of days when these newborns were receiving care beyond routine newborn care, I include use of ICU revenue codes alongside revenue codes for level II-IV nursery care in my main analysis when it is present on the episode.[42]

2. Evaluation and Management (E/M) CPT Codes for Inpatient Newborn Care

27. CPT codes are a standardized set of procedure codes that payers and physicians use to determine reimbursement of clinical services.[43] E/M codes are a class of procedure codes that physicians bill for assessing and managing medical care for their patients. E/M CPT codes are defined by site of care and/or type of service. For example, there are separate codes for inpatient, outpatient, and office-based services and for observation, consultation, and discharge services.[44]

28. There are four categories of E/M codes that physicians typically used in billing for newborns who receive care in the NICU. These categories are newborn care, hospital care, intensive care, and critical care. The individual CPT codes by category are listed in Table 1 along with associated descriptions from the 2019 edition of the American Medical Association's ("AMA") official CPT codebook, *CPT 2019 Professional Edition*.[45] These categories of codes are consistent with those appearing in the example

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41 There are approximately three thousand newborns who had at least one claim in an ICU; over three-quarters of these newborns were cared for by non-Mednax providers.

42 As mentioned in fn. 6 above, I refer to both level II-IV nursery care and ICU care when I use the term "NICU."

43 CPT 2019 Professional, p. v.

44 CPT 2019 Professional, pp. 1-3.

45 Kenneth P. Brin, ed., *CPT 2019 Professional Edition*, American Medical Association, 2018. Table 1 does not include the following codes: 99463, 99471, 99475, 99476, 99291, and 99292. My analysis focuses on newborns who are 28 days or younger as of the first day in the NICU and who spent less than 180 days in the NICU during their hospital stay (see Section V.D for additional information on the final sample of newborns in my analysis). Thus, 99471 (initial critical care code for patients 28 days through 24 months of age), 99475 (initial critical care code for patients 2 through 5 years of age), and 99476 (subsequent critical care code for patients 2 through 5 years of age) are outside of the age range of newborns in my analysis. 99291 and 99292 are critical care codes that are billed in time increments rather than per diem; these codes are typically billed by subspecialists who treat the newborn (CPT 2019 Professional, p. 47) or by the transferring physician (CPT 2019 Professional, p. 46). Less than 2 percent of newborns in Aetna's data have a claim with 99291 on a day in the NICU, and less than 1 percent have a claim with 99292 on a day in the NICU. 99463 is a newborn care code

rate agreement schedules between Aetna and Mednax that I have been provided.[46] The categories are also consistent with the E/M codes used in an internal billing codes analysis template that Mednax used when evaluating physician practice acquisitions.[47]

used in circumstances when the normal newborn is admitted and discharged on the same day; less than 1 percent of newborns in the NICU have a claim with 99463, and I consider 99463 as a discharge code alongside 99238 and 99239.

46 For example, see AETNA 1385-1424 (Pediatrix Medical Group of Louisiana, LLC).

47 For example, see MEDNAX01018717_ATTORNEY EYES ONLY.xlsx (Lalit K. Shah MD PA in Ft. Lauderdale, FL).

Table 1: Newborn, Hospital, Intensive, and Critical Care E/M CPT Codes

E/M Code	Description from CPT 2019 Professional
Newborn	
CPT 99460	"Initial hospital or birthing center care, per day, for ... normal newborn infant"
CPT 99462	"Subsequent hospital care, per day, for ... normal newborn"
Hospital	
CPT 99221	Initial hospital care (low complexity)
CPT 99222	Initial hospital care (moderate complexity)
CPT 99223	Initial hospital care (high complexity)
CPT 99231	Subsequent hospital care (low complexity)
CPT 99232	Subsequent hospital care (moderate complexity)
CPT 99233	Subsequent hospital care (high complexity)
Intensive	
CPT 99477	"Initial hospital care, per day, for ... the neonate, 28 days of age or younger, who requires intensive observation, frequent interventions, and other intensive care services"
CPT 99478	"Subsequent intensive care, per day, for ... the recovering very low birth weight infant (present body weight less than 1500 grams)"
CPT 99479	"Subsequent intensive care, per day, for ... the recovering low birth weight infant (present body weight of 1500-2500 grams)"
CPT 99480	"Subsequent intensive care, per day, for ... the recovering infant (present body weight 2501-5000 grams)"
Critical	
CPT 99468	"Initial inpatient neonatal critical care, per day, for ... a critically ill neonate, 28 days of age or younger"
CPT 99469	"Subsequent inpatient neonatal critical care, per day, for ... a critically ill neonate, 28 days of age or younger"
CPT 99472	"Subsequent inpatient neonatal critical care, per day, for ... a critically ill neonate, 29 days through 24 months of age"

Notes: Descriptions for newborn care from CPT 2019 Professional, p. 43; descriptions for hospital care from CPT 2019 Professional, pp. 16-17; descriptions for intensive care from CPT 2019 Professional, p. 48; descriptions for critical care from CPT 2019 Professional, p. 47.

29. As indicated in Table 1 above, there is a hierarchy of severity across the E/M codes for newborn care services[48] that increases from newborn to critical:[49]

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[48] In the remainder of my report, I use the term "E/M codes" to refer to the newborn, hospital, intensive, and critical care codes listed in Table 1.

[49] The discussion in this paragraph draws from the CPT 2019 Professional. See also American Academy of Pediatrics, "Newborn Coding Decision Tool 2019;" American Academy of Family Physicians, "Coding for Newborn Care Services," https://www.aafp.org/family-physician/practice-and-career/getting-paid/coding/newborn-care-services.html (last viewed on October 3, 2020); and Deborah Grider, "Revisiting Neonatal and Pediatric Critical Care Services," Critical Connections Issue 2019 – May 2 – Mentorship in Critical Care, Society of Critical Care Medicine,

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a. Newborn care codes are billed for normal newborns who do not have diagnoses that require frequent monitoring or medical treatment.

b. Hospital care codes are billed for newborns who require higher intensity of services than normal newborns but not "intensive observation, frequent interventions, and other intensive services," which would fall under intensive care.[50]

c. Intensive care codes are billed for a newborn who "is not critically ill but requires intensive observation, frequent interventions, and other intensive care services."[51] Both intensive care and critical care codes are bundled with additional services, such as endotracheal intubation, such that those additional services would not be separately reported.[52]

d. The guidelines on critical care are based on the CPT definition of critical illness or injury, which applies to all ages: "A critical illness or injury acutely impairs one or more vital organ systems such that there is a high probability of imminent or life-threatening deterioration in the patient's condition. Critical care involves high complexity decision making to assess, manipulate, and support vital system function(s) to treat single or multiple vital organ system failure and/or to prevent further life threatening deterioration of the patient's condition."[53]

30. The E/M codes for newborn care services in Table 1 also distinguish between care provided on the initial day and care provided on subsequent days. The reason for the distinction is that care provided on the initial day typically requires a more detailed or

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https://www.sccm.org/Communications/Critical-Connections/Archives/2019/Revisiting-Neonatal-and-Pediatric-Critical-Care-Se (last viewed on October 3, 2020).

50 CPT 2019 Professional, p. 47.

51 CPT 2019 Professional, p. 47. Services may include "intensive cardiac and respiratory monitoring, continuous and/or frequent vital sign monitoring, heat maintenance, enteral and/or parenteral nutritional adjustments, laboratory and oxygen monitoring, and constant observation by the health care team under direct supervision of the physician or other qualified health care professional" (p. 47).

52 CPT 2019 Professional, p. 47 and p. 46.

53 CPT 2019 Professional, p. 23.

comprehensive examination and more time.[54] Therefore, reimbursement rates will also differ between codes for care provided on initial and subsequent days in the NICU.

31. Provider payment guidelines from health insurers, including Aetna, are generally consistent with the guidelines from medical academies such as the American Academy of Pediatrics ("AAP") and American Academy of Family Physicians ("AAFP").[55]

32. More severe codes generally require increased levels of complexity and care by the physician. Accordingly, the rate agreements between Aetna and Mednax (as well as other providers) dictate higher dollar amounts to be used for higher-severity E/M codes than for lower-severity E/M codes. Table 2 shows an example of the average allowed amounts[56] for services provided by Mednax to Aetna newborns by E/M code for the calendar year 2016.[57] The table shows that initial codes demand higher payments than subsequent codes. In 2016, the average allowed amounts for intensive care subsequent codes were [redacted] to [redacted] per day compared with [redacted] to [redacted] per day for hospital care

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54 For example, AMA's guideline on floor time for initial hospital care ranges from 30 minutes to 70 minutes whereas the guideline is 15 to 35 minutes for subsequent hospital care; see CPT 2019 Professional, p. xxiii.

55 Additional examples of provider payment guidelines that are publicly available include Allways Health Partners, "Provider Payment Guidelines, Newborn Care (Inpatient)," February 13, 2020, https://resources.allwayshealthpartners.org/Provider/PPG/NewbornCareInpatient.pdf (last viewed on October 3, 2020); and Boston Medical Center HealthNet Plan, "Reimbursement Policy, Newborn and Neonatal Intensive Care Unit (NICU) Services," September 1, 2015, https://www.bmchp.org/-/media/204d5418d9f24ee88d9700a58341e962.ashx (last viewed on October 3, 2020).

Aetna does not publish coding standards; instead, Aetna's contracts state that it "utilizes nationally recognized coding structures such as AMA Current Procedural Technology - Fourth Edition (CPT-4), CMS Common Procedure Coding System (HCPCS), Diagnosis Related Groups (DRG), International Classification of Disease - Ninth Edition (ICD-9) diagnosis and procedure codes, National Drug Codes (NDC) and the American Society of Anesthesiologists (ASA) relative values for the coding a [sic] description of the services provided." See, for example, Aetna's contract with Pediatrix of Louisiana (AETNA 1385-1424) at -418.

56 An allowed amount is the "maximum amount a plan will play for a covered health care service. May also be called 'eligible expense,' 'payment allowance,' or 'negotiated rate.'" See "Allowed Amount," Healthcare.gov, https://www.healthcare.gov/glossary/allowed-amount/ (last viewed on October 22, 2020).

57 See also Klink Dep. Tr. at 105:5-20 ("Q. Ms. Klink, we discussed earlier the various levels of the E/M codes. Would you agree that the critical care codes are the most expensive of the categories we discussed? … A. Most expensive? The fee is larger for a critical care code, yes. Q. The bill is higher to a payer, whether it's Medicaid or Aetna, for critical care codes than it is for a hospital care code? A. Yes, it is. Q. And the same would hold true with intensive care codes? A. Yes.").

subsequent codes. Critical care subsequent codes were [redacted] to [redacted] per day, which is more than [redacted] times higher than hospital care subsequent codes.[58]

Table 2: Average Allowed Amount for Services Provided by Mednax to Aetna Newborns in 2016 by E/M Code

Category [1]	E/M Code [2]	Avg. Allowed Amount [3]
Newborn Care Codes		
[A] Initial	CPT 99460	[redacted]
[B] Subsequent	CPT 99462	[redacted]
Hospital Care Codes		
[C] Initial	CPT 99221	[redacted]
[D] Initial	CPT 99222	
[E] Initial	CPT 99223	
[F] Subsequent	CPT 99231	[redacted]
[G] Subsequent	CPT 99232	
[H] Subsequent	CPT 99233	
Intensive Care Codes		
[I] Initial	CPT 99477	[redacted]
[J] Subsequent	CPT 99478	[redacted]
[K] Subsequent	CPT 99479	
[L] Subsequent	CPT 99480	
Critical Care Codes		
[M] Initial	CPT 99468	[redacted]
[N] Subsequent	CPT 99469	[redacted]
[O] Subsequent	CPT 99472	

Notes: See Column [J] of Table 5 and Appendix D of the Expert Report of Michael I. Cragg, Ph.D. (October 26, 2020).

33. My analysis studies the frequency at which Mednax billed codes in the two higher-severity levels, either intensive or critical care. The reason why I focus on this split between newborn/hospital[59] versus intensive/critical care codes is to isolate the shift

58 [redacted].

59 At the lower end, I include both newborn and hospital care codes in my analysis. The reason why I include newborn care codes is that providers may bill a newborn care code if it is appropriate for the

from hospital care to intensive care, as opposed to from newborn care to hospital care or from intensive care to critical care.

3. Illustrative Examples of Episodes in the NICU

34. To show how E/M codes and nursery levels come together in the claims data, I provide illustrative examples of newborn episodes in Figure 1 through Figure 3. Figure 1 presents a hypothetical scenario where the patient ("Newborn A") was born on January 1 and received level III nursery care after birth. A neonatologist managed the newborn's care, and her services were billed as intensive codes each day until Newborn A was discharged home on January 6. Based on the number of days when Newborn A received level III nursery care, the number of days in the NICU was five days (January 1 through January 5). There were five intensive codes billed for the neonatologist's services, which is equivalent to 100 percent of the E/M codes billed during the episode.

Figure 1: Illustrative Example of Newborn A's Episode in the NICU

	Jan 1	Jan 2	Jan 3	Jan 4	Jan 5	Jan 6
Physician	Initial Intensive	Subsequent Intensive	Subsequent Intensive	Subsequent Intensive	Subsequent Intensive	Discharge
Hospital	Level III Nursery Care	Level III Nursery Care	Level III Nursery Care	Level III Nursery Care	Level III Nursery Care	

35. Suppose that there was a second newborn ("Newborn B") born on the same day as Newborn A, January 1. Similar to Newborn A, Newborn B also received level III nursery care from the delivery room. The neonatologist's time for evaluating Newborn B was billed as an initial intensive care code on the first day and subsequent intensive care codes each day until Newborn B was discharged on January 5. Newborn B was in the NICU for four days (January 1 through January 4), and all E/M codes billed for Newborn B were intensive. A summary of Newborn B's episode in the NICU is shown in Figure 2. Relative to Newborn A, there was one less intensive care code billed for Newborn B's care because Newborn B spent one less day in the NICU.

newborn's condition (CPT 2019 Professional, pp. 47-48). My results are robust to focusing on hospital, intensive, and critical care codes only; see "Linear Model_HIC.xlsx" in my workpapers.

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Figure 2: Illustrative Example of a Newborn B's Episode in the NICU—Fewer Number of Days in the NICU

	Jan 1	Jan 2	Jan 3	Jan 4	Jan 5	Jan 6
Physician	Initial Intensive	Subsequent Intensive	Subsequent Intensive	Subsequent Intensive	***Discharge***	
Hospital	Level III Nursery Care	Level III Nursery Care	Level III Nursery Care	Level III Nursery Care		

36. Figure 3 presents an example of a third newborn, Newborn C, who was also born on the same day as Newborns A and B and admitted to the NICU from the delivery room. Similar to Newborns A and B, initial and subsequent intensive care codes were billed for Newborn C's care through January 4. On the day prior to Newborn C's discharge, the provider billed a subsequent hospital care code instead of a subsequent intensive care code. Newborn C spent five days in the NICU (January 1 through January 5), and four out of five or 80 percent of E/M codes billed during the newborn's stay in the NICU were intensive care codes. Newborns A and C spent the same number of days in the NICU; however, Newborn C has one less intensive care code than Newborn A because care for Newborn C was billed as subsequent hospital care rather than subsequent intensive care on the day prior to discharge.

Figure 3: Illustrative Example of a Newborn C's Episode in the NICU—Lower Severity E/M Code on the Day Prior to Discharge from the NICU

	Jan 1	Jan 2	Jan 3	Jan 4	Jan 5	Jan 6
Physician	Initial Intensive	Subsequent Intensive	Subsequent Intensive	Subsequent Intensive	***Subsequent Hospital***	Discharge
Hospital	Level III Nursery Care	Level III Nursery Care	Level III Nursery Care	Level III Nursery Care	Level III Nursery Care	

37. Figure 1-Figure 3 above illustrate that a newborn may have more intensive or critical care codes because (i) the newborn may have had a longer stay in the NICU (comparing Newborn A with Newborn B) and/or (ii) one or more of the E/M codes billed for the newborn's care was shifted from a lower to higher severity level (comparing Newborn A with Newborn C). In my analyses, I study the overall difference in the number of intensive or critical care codes between Mednax and non-

Mednax newborns and whether the difference is driven by having longer stays in the NICU or by shifting from lower- to higher-severity E/M codes.

V. DATA PREPARATION AND SOURCES

38. To evaluate the billing patterns of Mednax, I analyze Aetna's claims data. Health insurance claims data has been used in highly regarded peer-reviewed articles that study a wide range of questions in health economics, such as geographic variation in growth of health spending among privately insured individuals.[60] One advantage of claims data is that I am able to identify the procedure and diagnosis codes billed by a specific provider, such as a Mednax physician group. In addition, I supplement Aetna's claims data with information from public sources about hospitals and local demographics that I use to account for other potential differences between Mednax and non-Mednax newborns that may influence billing.

A. VARIABLES BASED ON AETNA CLAIMS DATA

39. The primary data source that I use in my analyses is an extract of Aetna commercial insurance claims data of births covering the period January 1, 2009 through February 27, 2019. This extract contains all deliveries and births where claims were submitted to Aetna for care involving the mother or newborn and including any subsequent inpatient care taking place for a newborn.[61] The data also includes approximately 9 months of claims history for mothers covering the period leading up to their admission for a delivery.

40. I perform my analyses at the episode level. This is for a number of reasons. First, the care that a patient receives during a hospital stay is typically recorded in the claims data across each of a patient's care providers, including both hospitals and physicians, who

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60 For example, see Zack Cooper et al., "Variation In Health Spending Growth For the Privately Insured From 2007 To 2014," *Health Affairs* 38 no. 2 (2019): 230-236. Cooper et al. use claims data from Aetna, Humana and UnitedHealthcare that are compiled by the Health Care Cost Institute. For a review of academic papers at the intersection of health economics and industrial organization that have used health insurance claims data, see Martin Gaynor et al., "The Industrial Organization of Health-Care Markets," *Journal of Economic Literature* 53 no. 2 (2015): 260.

61 Deposition of Richard Harris, Aetna Executive Director, May 11, 2020.

each submit one or more claims for their respective services. Analyzing at the episode level allows me to look at the entirety of the care provided to a patient and across providers during the hospital, including instances where a baby was transferred to another hospital facility for a portion of its care. Second, in the peer-reviewed literature, an episode-level analysis is a widely accepted methodology used by researchers to study aspects of care in NICU settings and length of stay.[62]

41. I identify each episode by looking at contiguous days where a newborn was treated as a patient in an inpatient setting. Within these episodes, I identify the specific portion(s) that involve more than normal newborn care by focusing on days where a hospital bills for the NICU.

42. I use the claims data to calculate the number of intensive or critical care codes that were billed for newborns in the NICU and the number of days that the newborn stayed in the NICU. I also use the claims data to construct variables that I include as controls for potential confounding factors in my analyses, including characteristics of the newborn and birth (such as gestational age, birth weight, and C-section or vaginal birth), diagnoses recorded during the episode for the newborn, characteristics of the newborn's mother, and facility resource usage across episodes. Details regarding my steps to prepare the claims data for analysis are provided in Appendix C.

B. Identification of Mednax in the Claims Data

43. I determine whether a specific claim in the Aetna claims data involves a Mednax provider by using the provider's tax identifier number (TIN). To identify which TINs were part of the Mednax organization over time, I start with the TINs provided by Mednax in this matter.[63] I then take two additional steps to ensure the lists are comprehensive and to account for the timing when specific physician groups were

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[62] As examples, see Seth Freedman, "Capacity and Utilization in Health Care: The Effect of Empty Beds on Neonatal Intensive Care Admission," *American Economic Journal: Economic Policy* 8 no. 2 (2016): 154-185 ("Freedman (2016)") and Hitoshi Shigeoka and Kiyohide Fushimi, "Supplier-induced demand for newborn treatment: Evidence from Japan," *Journal of Health Economics* 35 (2014): 162-178 ("Shigeoka and Fushimi (2014)"). Because of data accessibility, researchers often work with hospital discharge data, which is effectively arranged at the episode level.

[63] MEDNAX01133041 and "2019.03.18 Identification of Practice Groups.pdf" produced by Mednax on March 18, 2019, pursuant to Court Order.

acquired during the period. These two steps identify a small number of additional TINs that I include in my analysis. One step is to supplement the list by using string searches for Mednax's neonatal units (such as "Pediatrix") across provider names in the claims data. A second step is to account for acquisitions of specific provider groups extracted from S&P's Capital IQ database as well as online press releases from Mednax involving its transactions. Appendix C and my workpapers detail this identification process.

44. I determine whether a newborn was under Mednax's care based on the share of E/M codes billed by Mednax in the NICU. My analyses focus on comparing newborns for whom Mednax billed all of the E/M codes in the NICU with newborns for whom Mednax billed none of the E/M codes in the NICU. These two groups of newborns comprise more than 98 percent of newborns in my sample for analysis.[64] Focusing my analysis on newborns for whom either all or none of the E/M codes during the episode were billed by Mednax or by non-Mednax providers eliminates any ambiguity as to whether Mednax (or non-Mednax) providers billed the intensive or critical care codes.

C. Additional Datasets for Local Demographics and Hospital Characteristics

45. In addition to the claims data, I use publicly available sources for constructing additional controls that I incorporate in my analyses. These sources are:

a. U.S. Census for demographic characteristics by zip code and year;

b. Center for Medicare & Medicaid Services ("CMS") Healthcare Cost Report Information System ("HCRIS") for hospital characteristics such as rural status and number of NICU beds;

[64] In other words, approximately less than 2 percent of newborns in my sample for analysis have both Mednax and non-Mednax providers billing E/M codes on different days. This is consistent with Mednax's statement in its 2010 presentation at the JP Morgan Healthcare Conference that it had "mostly exclusive relationships" with hospitals; see Mednax, JP Morgan Healthcare Conference Presentation, January 13, 2010, https://mednax.gcs-web.com/presentations (last viewed on October 3, 2020), p. 11.

c. AAP NICU Search as an alternative source to HCRIS for number of NICU beds and AAP NICU level among hospitals in Texas;

d. CMS Teaching Hospital List for the teaching status of a hospital; and

e. Agency for Healthcare Research and Quality ("AHRQ") in the U.S. Department of Health and Human Services for information on diagnosis codes and classifications.

46. Details about these datasets and variable construction are included in Appendix C.

D. Final Sample of Newborns Included in the Analysis

47. The final sample of newborns included in my analyses consists of newborns who meet the following four criteria:

a. Newborns who had at least one claim for one or more nights in the NICU based on revenue codes;[65]

b. Newborns for whom E/M codes were billed in the NICU;

c. Newborns who spent less than 180 days in the NICU;[66] and

d. Newborns whose hospital stays began at birth and ended with a hospital discharge code and who had at least one E/M code billed on each day in the NICU.[67] These patients represent the majority of newborns with observed

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65 I include patients who were 28 days or younger on the first day of the claim associated with a NICU revenue code (172-174 or 200-209). My analysis evaluates newborn, hospital, intensive, and critical care codes billed for the care of newborns in the NICU; since initial intensive codes are specific to newborns 28 days or younger, I focus on patients who fit this requirement.

66 Over 99 percent of newborns who were in the NICU for at least one night spent less than 180 days in the NICU. The exclusion of newborns who stayed 180 days or more in the NICU helps to avoid the possibility that the results may be driven by a small number of newborns who had unique circumstances.

67 My analysis includes newborn episodes that have a NICU-related revenue code only on the first and/or last day. The first and/or last day in the NICU may not have an E/M code in circumstances such as if the newborn was admitted to the NICU at night or if the newborn was discharged early in the day. I spoke with Dr. Evans over the phone on October 7, 2020. Dr. Evans confirmed that, in her experience, a provider may not have billed a per diem E/M code in those situations.

E/M codes in the NICU,[68] and focusing my analysis of alleged overbilling on these newborns reduces the number of potentially confounding factors.[69]

48. The descriptive statistics and model results throughout my report and appendices are, unless otherwise noted, based on the newborns described above.

VI. DESCRIPTIVE STATISTICS SHOW THAT MEDNAX NEWBORNS HAD, ON AVERAGE, MORE INTENSIVE OR CRITICAL CARE CODES PER EPISODE

49. In this section, I present descriptive statistics that show Mednax newborns had, on average, more intensive or critical care codes per episode than non-Mednax newborns. The tabulations are based on averages from the data before controlling for other potential differences between Mednax and non-Mednax patients. Analyzing descriptive statistics is a well-accepted practice in the academic literature because descriptive statistics are a clear way to summarize the data prior to the application of econometric techniques.[70]

50. Table 3 compares the average number of E/M codes per episode between Mednax and non-Mednax newborns across all NICU episodes. Column [A] of Table 3 reports the average number of newborn, hospital, intensive, or critical care codes billed in the NICU per episode among newborns under Mednax's care. Column [B] shows the average number of E/M codes billed in the NICU per episode among newborns under the care of non-Mednax providers. The difference in the average number of codes billed in the NICU per episode between Mednax and non-Mednax newborns is reflected in column [C]. Mednax newborns had, on average, 14.2 E/M codes billed in the NICU per episode (row [5]); 10.1 of the codes were intensive and 3.8 were critical (rows [3] and [4], respectively). Non-Mednax newborns had, on average, 8.9 E/M codes billed in the NICU per episode, where 5.8 codes were intensive and 2.2 codes

68 See Table 14 in Appendix C, Section D.

69 The conclusions of my analysis hold if I include newborns who did not have a discharge code on the last day of the episode (see Appendix F). Applying the requirements described in ¶ 47.d ensures that I observe the full length of the episodes and that there is no difference in the frequency at which providers bill E/M codes for Mednax and non-Mednax newborns in the NICU.

70 For example, Table 1 of Shigeoka and Fushimi (2014).

were critical. Overall, Mednax newborns had 5.9 more intensive or critical codes in the NICU per episode than non-Mednax newborns.

Table 3: Comparison of Average Number of E/M Codes in the NICU Between Mednax and Non-Mednax Newborns

	Number of E/M Codes Billed in the NICU Per Episode			
	Mednax [A]	Non-Mednax [B]	Diff: Med - Non [C]=[A]-[B]	Diff. as % Med [D]=[C]/[A]
[1] Newborn	0.1	0.4	-0.3	-307.9%
[2] Hospital	0.2	0.5	-0.4	-254.5%
[3] Intensive	10.1	5.8	4.3	42.4%
[4] Critical	3.8	2.2	1.6	42.1%
[5] *Any E/M Code*	*14.2*	*8.9*	*5.3*	*37.0%*
[6] Intensive or Critical	14.0	8.0	5.9	42.3%

Notes: See Section V.D for a full description of the final sample of newborns included in the analysis. E/M stands for newborn care, hospital care, intensive care, or critical care E/M CPT codes that are listed in Table 1.

51. As I discussed in Section IV.B.3 with illustrative examples of newborns in the NICU, the overall difference in the number of intensive or critical care codes may be driven by longer stays in the NICU and/or by a shift from lower-severity E/M codes to higher-severity E/M codes during newborn's stay in the NICU ("substitution effect"). Below, I first compare the number of days that Mednax and non-Mednax newborns stay in the NICU and then compare the number of higher-severity E/M codes billed relative to lower-severity E/M codes between the two groups.

52. Table 4 focuses on the difference between Mednax and non-Mednax newborns with regard to the number of days in the NICU. The table shows the distribution in the number of days across newborns. The 50th percentile indicates that half of Mednax newborns spent 7.0 days or less in the NICU whereas half of non-Mednax newborns spent 4.0 days or less in the NICU. On average, Mednax newborns spent 14.4 days in the NICU, and non-Mednax newborns spent 9.3 days in the NICU, which is 5.1 fewer days then Mednax newborns.

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Table 4: Comparison of the Distribution of Number of Days in the NICU Between Mednax and Non-Mednax Newborns

	Number of Days in the NICU			
	Mednax [A]	Non-Mednax [B]	Diff: Med - Non [C]=[A]-[B]	Diff. as % Med [D]=[C]/[A]
[1] 10th Percentile	2.0	1.0	1.0	50.0%
[2] 25th Percentile	3.0	2.0	1.0	33.3%
[3] 50th Percentile	7.0	4.0	3.0	42.9%
[4] 75th Percentile	17.0	10.0	7.0	41.2%
[5] 90th Percentile	35.0	22.0	13.0	37.1%
[6] Mean	14.4	9.3	5.1	35.7%

Notes: See Section V.D for a full description of the final sample of newborns included in the analysis. Number of days in the NICU is a count of calendar days in the NICU based on revenue codes 172-174 and 200-209.

53. Figure 4 compares the average number of intensive or critical care codes per episode for newborns who spent the same number of days in the NICU. The figure highlights the substitution effect in which Mednax billed additional intensive or critical care codes instead of newborn or hospital care codes. Figure 4 plots the average number of intensive or critical care codes in the NICU per episode for Mednax (in light blue with circles) and non-Mednax (in dark blue with squares).[71] When the light blue line with circles is above the dark blue line with squares, it means that the average number of intensive or critical care codes for Mednax newborns is higher than the average number for non-Mednax for newborns with the same number of days in the NICU. The figure shows that the difference in number of intensive or critical care codes persists for stays in the NICU as short as two days as well as stays up to 19 days in the NICU.[72]

[71] Figure 4 shows the average number of intensive or critical care codes per episode for stays in the NICU up to 19 days. This range covers approximately 79 percent of Mednax newborns and 88 percent of non-Mednax newborns who meet the criteria in Section V.D above.

[72] Figure 6 in Appendix D shows the difference between Mednax and non-Mednax (which would be the gap between the two lines in Figure 4 for newborns who had the same number of days in the NICU) for stays up to 179 days in the NICU.

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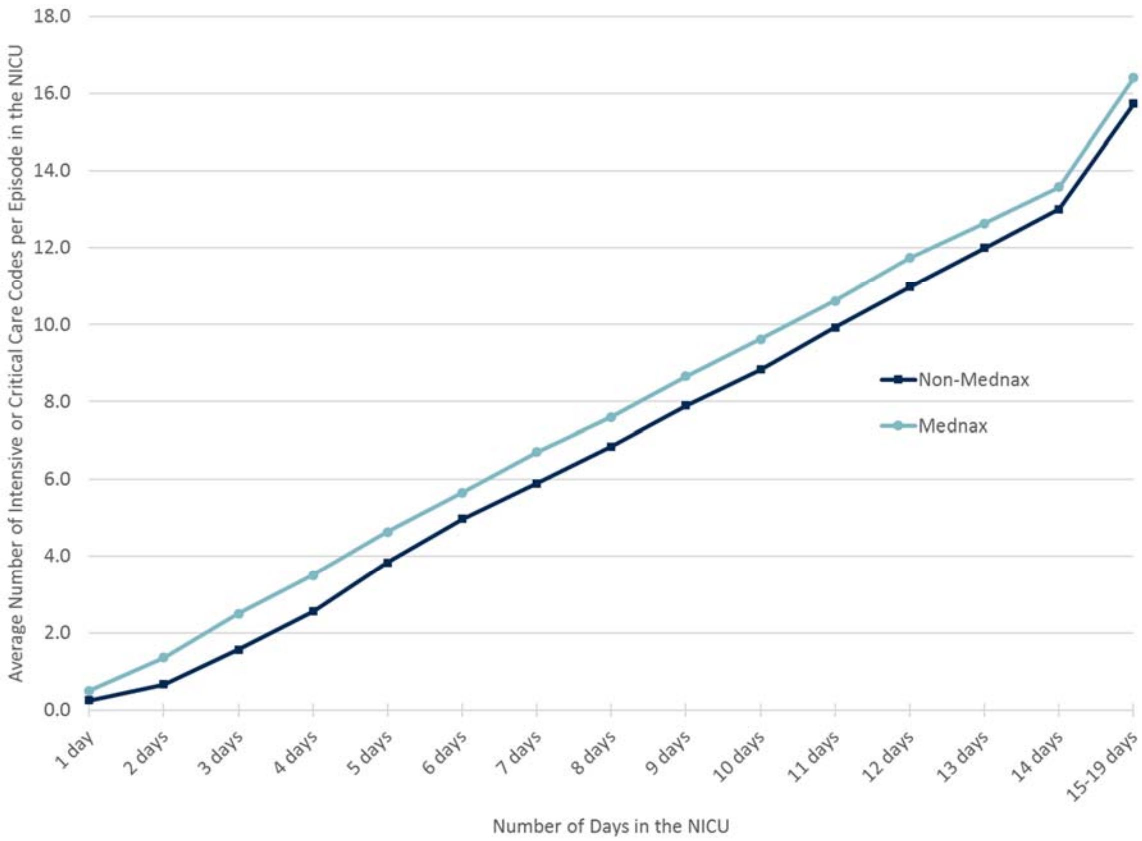
Figure 4: Average Number of Intensive or Critical Care Codes per Episode by Number of Days in the NICU



Notes: See Section V.D for a full description of the final sample of newborns included in the analysis. Number of days in the NICU is a count of calendar days in the NICU based on the revenue codes 172-174 and 200-209.

54. Figure 5 presents another view of the frequency at which Mednax billed intensive or critical care codes. The figure shows the percent of newborns where only intensive or critical care codes were billed while the newborn was in the NICU. More than 85 percent of Mednax newborns in the NICU for three days only had intensive or critical care codes in the NICU compared with less than 50 percent of non-Mednax newborns. For stays longer than four days, well over 90 percent of Mednax newborns only had intensive or critical care codes billed in the NICU. Figure 5 shows that Mednax providers rarely billed newborn or hospital care codes in the NICU relative to non-Mednax providers.

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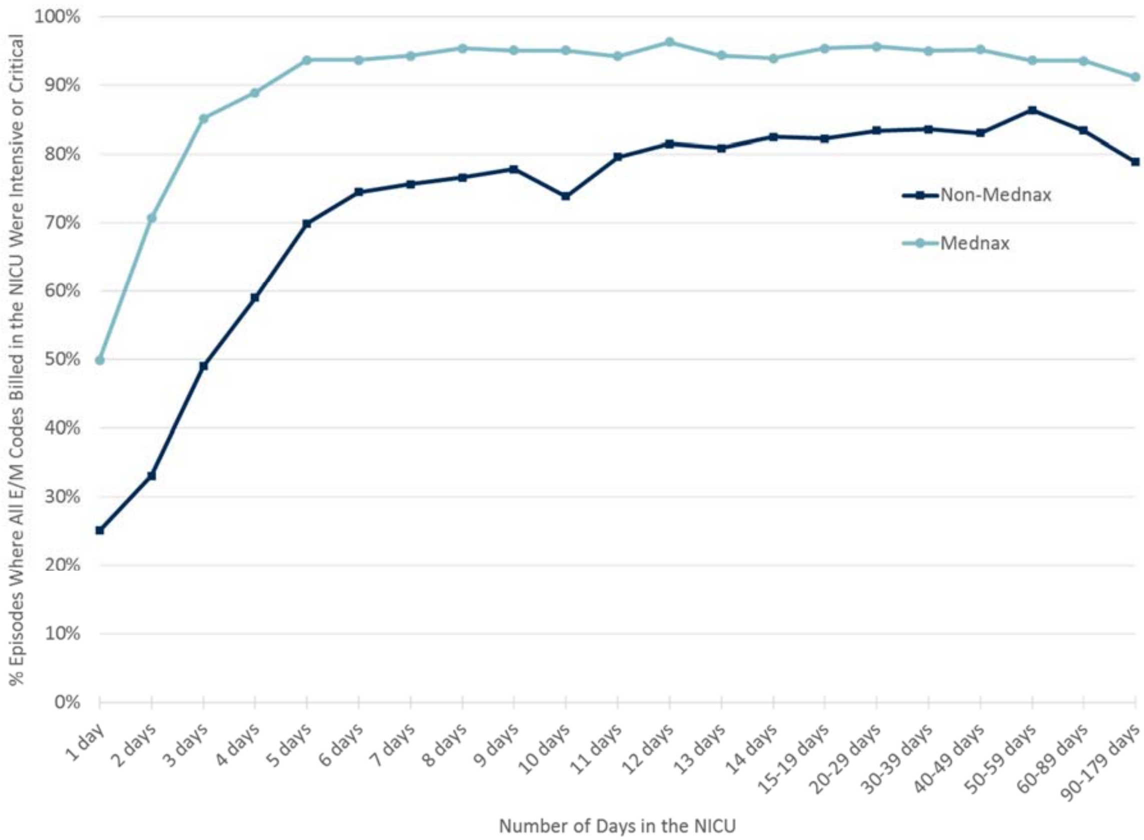
Figure 5: Share of Newborns where Intensive or Critical Care Codes Comprised All of the E/M Codes Billed in the NICU



Notes: See Section V.D for a full description of the final sample of newborns included in the analysis. Number of days in the NICU is a count of calendar days in the NICU based on the revenue codes 172-174 and 200-209. Lines plot the share of episodes where all E/M codes in the NICU were either intensive or critical care.

55. The descriptive statistics presented in this section demonstrate that there is a difference in number of intensive or critical care codes billed for care of Mednax newborns in the NICU relative to non-Mednax newborns.[73] The descriptive statistics also show that Mednax newborns had, on average, longer stays in the NICU, and even among newborns who spent the same number of days in the NICU, Mednax newborns had more intensive or critical care codes rather than newborn or hospital care codes. As I will discuss in the next section, these differences are present even after I control for potentially confounding factors, such as differences in the underlying characteristics of newborns treated in the NICU relative to other providers.

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[73] In my econometric analysis described in Section VII, I test whether the differences are statistically significant; see fn. 85 below on statistical significance.

VII. ACCOUNTING FOR POTENTIALLY CONFOUNDING FACTORS, MEDNAX NEWBORNS IN THE NICU HAD MORE INTENSIVE OR CRITICAL CARE CODES BILLED FOR THEIR CARE THAN NON-MEDNAX NEWBORNS

56. To account for potential confounders (such as differences in gestational age between Mednax and non-Mednax newborns), I use a standard econometric regression approach. Econometric regression models are widely used and accepted by researchers and courts to estimate the difference in an outcome between two groups, such as newborns treated by Mednax and non-Mednax providers, after accounting for differences in these confounders.[74] The outcomes that I analyze are (1) the number of intensive or critical care codes billed for care of the newborn in the NICU and (2) the number of days that the newborn stayed in the NICU. In Section VII.A, I describe my approach to identify potential confounders and to account for these confounders in a regression framework. In Section VII.B, I present the results of my analysis after accounting for these potential confounders. The following section, Section VIII, will discuss additional tests that I run to address alternative explanations for my results.

A. Approach to Accounting for Potentially Confounding Factors of E/M Billing in the NICU

57. I utilize a standard econometric approach called a linear regression model to test whether Mednax systematically billed more intensive or critical care codes in the NICU.[75] The regression model framework can account for differences between Mednax and non-Mednax newborns in the NICU by controlling for potential confounders.

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[74] For example, researchers compared C-section rates between mothers who are and are not physicians and found that mothers who are physicians are less likely to receive a C-section; see Erin M. Johnson and M. Marit Rehavi, "Physicians Treating Physicians: Information and Incentives in Childbirth," *American Economic Journal: Economic Policy* 8 no. 1 (2016): 115-141.

[75] Details of my linear regression model, including the equation that I estimate, are enclosed in Appendix E, Section A. In addition to Shigeoka and Fushimi (2014), peer reviewed papers that have used econometric approaches, including linear regression models, to test for provider billing practices in response to changes in payment include Leemore Dafny, "How Do Hospitals Respond to Price Changes?," *American Economic Review* 95 no. 5 (February 2005): 1525-1547; Elaine Silverman and Jonathan Skinner, "Medicare upcoding and hospital ownership," *Journal of Health Economics* 23 (2004): 369-389; John R. Bowblis and Christopher S. Brunt, "Medicare Skilled Nursing Facility Reimbursement and Upcoding," *Health Economics* 23 (2014): 821-840; and Michael Geruso and Timothy Layton, "Upcoding: Evidence from Medicare on Squishy Risk Adjustment," *Journal of Political Economy* 128 no. 3 (2020): 984-1026.

"Controlling for" means that the model allows some portion of the difference in the outcome (such as the number of intensive or critical care codes) to be ascribed to the potential confounder if such a relationship can be estimated from the data.

58. I reviewed the academic literature studying NICU care to identify potential confounders of utilization in the NICU.[76] Broadly speaking, potential confounders may be classified into three groups:

    a. Newborn health risks;

    b. Capabilities of the hospital where the newborn is treated; and

    c. Changes over time in, for example, state regulatory standards.

59. Newborn health risks include birth weight, gestational age, C-section versus vaginal delivery, singleton versus twins or multiples, sex, age when admitted to the NICU, diagnoses, facility resource usage, and patient demographics. In particular, the newborn's birth weight and gestational age are key indicators of the infant's health and treatment decisions.[77] C-section and twins or multiples are also generally viewed as newborns at higher risk.[78] I include a rich set of controls for diagnoses indicating newborn health risk in the NICU based on two peer-reviewed studies, Friedman et al. (2002) and Phibbs et al. (2007). In particular, Friedman et al. (2002) use classes of diagnoses that are designated as problems of birth or the perinatal period based on the Clinical Classification System, which is maintained by the Agency for Health Research Quality in the U.S. Department of Health and Human Services, and I use these classes

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[76] In addition to Freedman (2016) and Shigeoka and Fushimi (2014), see Ciaran S. Phibbs et al., "Level and Volume of Neonatal Intensive Care and Mortality in Very-Low-Birth-Weight Infants," *The New England Journal of Medicine* 356 (2007): 2165-2175; Bernard Friedman et al., "The Use of Expensive Health Technologies in the Era of Managed Care: The Remarkable Case of Neonatal Intensive Care," *Journal of Health Politics, Policy and Law* 27 no. 3 (June 2002): 441-464; Wade Harrison and David Goodman, "Epidemiologic Trends in Neonatal Intensive Care, 2007-2012," *JAMA Pediatrics* 169 no. 9 (September 2015): 855-862; and Douglas Almond et al., "Estimating Marginal Returns to Medical Care: Evidence from At-Risk Newborns," *Quarterly Journal of Economics* (May 2010): 591-634.

[77] See, e.g., Douglas Almond et al., "Estimating Marginal Returns to Medical Care: Evidence from At-Risk Newborns," *Quarterly Journal of Economics* (May 2010): 596.

[78] See, e.g., Wade Harrison and David Goodman, "Epidemiologic Trends in Neonatal Intensive Care, 2007-2012," *JAMA Pediatrics* 169 no. 9 (September 2015): 857; AAP 2012 Policy Statement, p. 591.

of diagnoses in my main model.[79] Facility resource usage—such as operating rooms and respiratory support—are indicators of severe medical conditions.[80] Lastly, the patient's demographics may also play a role in his or her health risk; in the absence of information about the patient's demographics from Aetna's claims data, I proxy for race, education, and income using zip-code averages from the U.S. Census.

60. Some newborn health risks, such as birth weight and gestational age or the patient's demographics, are observed at birth before the newborn enters the NICU. Other health risks, such as diagnoses and facility resource usage, are determined over the course of the newborn's stay in the NICU. I distinguish between these two sets of health characteristics in my analysis because health risks that are determined during the newborn's stay in the NICU may be influenced by the provider in the NICU, such as Mednax, whereas health risks that are known prior to the newborn's admission into the NICU are less likely to be influenced.

61. I understand that BabySteps—Mednax's proprietary billing system in the NICU—allows physician groups to have a pre-determined "initial setup" of "problems" from which the neonatologist can select.[81] After the physician selects a problem and answers a series of questions, the software generates a diagnosis code to be applied to the claim.[82] Mednax's coding department developed the "mapping" between these problems and the diagnosis code generated by BabySteps and also developed the ranking of the diagnosis codes.[83] In addition, BabySteps shows an "intensive cardiac monitoring statement" and "critical question" that solicit responses from the physician that the algorithm directly translates into intensive or critical E/M codes when answered

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79 "Clinical Classification Software (CCS) for ICD-9-CM," Healthcare Cost and Utilization Project, Agency for Healthcare Research and Quality, https://hcup-us.ahrq.gov/toolssoftware/ccs/ccs.jsp (last viewed on October 10, 2020).

80 Researchers have used procedures to infer severe complications; for example, see Katherine H. Campbell et al., "Optimal maternal and neonatal outcomes and associated hospital characteristics," *Birth* (2018): 1-11. In my analysis, I use hospital revenue codes to infer complications; see Appendix C, Section A.3.e for details.

81 Bryant Dep. Tr. at 82:25-85:24.

82 Bryant Dep. Tr. at 78:5-79:2.

83 Bryant Dep. Tr. at 86:14-87:20.

in the affirmative.[84] Based on this information about the attributes of the BabySteps system, I find it possible that the diagnoses recorded during the newborn's stay in the NICU might also be influenced by Mednax, to the extent that Mednax is also overbilling higher-severity E/M codes.

62. The second category of potential confounders include capabilities of the hospital where the newborn is treated. For some hospitals, I was able to collect information from public sources on the number of NICU beds, rural status of the hospital, and teaching status of the hospital. In addition, for the state of Texas – the state with the largest Mednax presence in the Aetna data – I collected information on AAP NICU level and AAP NICU bed count for some hospitals. The facility's capabilities may affect the treatment decision for the newborn in the NICU; as an illustrative example, teaching hospitals may treat newborns more intensely given the training of its hospital staff and equipment available.

63. The third category of potential confounders includes potential differences driven by the geographic regions or time periods being analyzed, such as differences in regulatory standards. To capture these potential effects, I allow for state-specific time trends in my model. In other words, the average number of intensive or critical care codes per episode or the average number of days in the NICU may have trended differently across states, and my analysis focuses on comparisons between newborns who received care in the NICU in the same year and state.

64. In my main analysis, I compare the number of intensive or critical care codes per episode in the NICU as well as the number of days in the NICU between Mednax and non-Mednax newborns who were covered by Aetna. The model estimates the average difference in these outcomes after accounting for the potential confounders that are listed above. A positive result indicates that Mednax newborns had, on average, more intensive or critical care codes in the NICU or spent more days in the NICU than non-Mednax newborns. The model also provides an estimate of degree of certainty that there is no statistical difference between Mednax and non-Mednax newborns

84 Bryant Dep. Tr. at 94:22-96:25.

("statistical significance"[85]). In my results, I indicate whether the difference is statistically different from zero based on well-accepted significance levels frequently reported by academic researchers.[86]

B. Results of the Regression Analysis Show that Newborns Under Mednax's Care Had More Intensive or Critical Care Codes in the NICU and Had Longer Stays in the NICU

65. I present my main estimates of the overall difference in the average number of intensive or critical care codes billed in the NICU between Mednax and non-Mednax newborns in Table 5. Column [1] shows the average difference before adding controls for potential confounders in the model. On average, Mednax billed 5.91 additional intensive or critical care codes in the NICU, and this result matches with row [6], column [C] in Table 3.

66. Columns [2] through [5] of Table 5 show estimates of the Mednax differential as potential confounders (i.e., controls) are included in the regression model. I start by adding controls for potential confounders that are observed when the newborn is admitted to the NICU; these characteristics are unlikely to be influenced by the providers' actions during the newborn's NICU stay. Column [2] shows the Mednax differential after accounting for differences in birth characteristics, such the newborn's birth weight and gestational age. The difference remains positive at 2.63 additional codes in the NICU. In column [3], I also control for hospital characteristics, patients' demographics based on their zip codes, and state-specific trends. The Mednax differential remains at 2.35 additional intensive or critical care codes relative to non-Mednax newborns. Columns [4] and [5] add controls for facility resource usage and diagnoses, some of which were entered while the newborn was in the NICU. To the extent that diagnoses or facility resource usage may have been influenced by Mednax in the NICU, the estimates in column [4] and [5] are conservative. Even so, newborns

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85 James H. Stock and Mark W. Watson, *Introduction to Econometrics Third Edition* (Pearson, 2015), p. 782.

86 I report significance levels of 1 percent, 5 percent, and 10 percent, where 1 percent is the most stringent level associated with a higher degree of certainty that the Mednax differential is not zero. See Table 4 of Shigeoka and Fushimi (2014) and Table V of Bowblis and Brunt (2014) for as examples of researchers who also report statistical significance at these three levels.

in the NICU who were cared for by Mednax had 1.84 to 1.90 additional intensive or critical care codes than non-Mednax newborns who shared similar characteristics. All models indicate that the difference in the number of intensive or critical care codes billed in the NICU between Mednax and non-Mednax providers is statistically significant.

Table 5: Mednax Newborns Had, on Average, More Intensive or Critical Care Codes Billed in the NICU than Non-Mednax Newborns

	Without Controls [1]	Birth Charac. Only [2]	Charac. Known Prior to NICU Stay [3]	All Charac. Except Dx [4]	All Charac. Including Dx [5]
Avg. Difference between Mednax and Non-Mednax	5.911*** (0.442)	2.625*** (0.187)	2.349*** (0.186)	1.899*** (0.180)	1.841*** (0.175)
Controls included in the model:					
Birth characteristics		Y	Y	Y	Y
Hospital characteristics			Y	Y	Y
Zip-code demographics			Y	Y	Y
State-year time trends			Y	Y	Y
Facility resource usage				Y	Y
Diagnoses during hospital stay					Y
Number of observations	127578	127578	127578	127578	127578
Number of clusters (hospitals)	2186	2186	2186	2186	2186

Notes: Standard errors are clustered by hospital where the newborn received care in the NICU. The unit of observation is a newborn's episode in the NICU (revenue codes 172-174 and 200-209). The outcome is the number of intensive or critical care codes billed in the NICU. The "Avg. Difference between Mednax and Non-Mednax" is the coefficient estimate on the Mednax indicator, which equals one if all E/M codes in the NICU were billed by Mednax. The comparator group includes all newborns in the NICU cared for by non-Mednax providers who meet the criteria for the final sample (see Section V.D) in Aetna's claims dataset. See Appendix E, Section A for a complete list of controls. "Dx" stands for diagnoses, and "Y" stands for yes. ***p<0.01, **p<0.05, *p<0.10

67. In Table 6 and Table 7, I show the results of the regression models that analyze the number of days when the newborn was cared for in the NICU and the number of intensive or critical care codes billed in the NICU instead of newborn or hospital care codes for newborns with the same number of days in the NICU, respectively. Both tables show that the average Mednax differential is positive and statistically significant.

a. As shown in Table 6, Mednax newborns spent, on average, more days in the NICU than non-Mednax newborns. The difference ranges from 1.31 days to 1.77 days (columns [5] and [3] of Table 6, respectively) where 1.31 days may be a lower bound when all potential confounders are included in the model including diagnoses that would have been entered while the newborn was in

the NICU. The upper end of the range, 1.77 days, is based on a model that controls for newborn health and other characteristics that are known prior to receiving care in the NICU. Consistent with the descriptive statistics in Section VI, Mednax newborns had, on average, longer stays in the NICU than non-Mednax newborns.

b. Regarding the substitution effect from lower-severity to higher-severity E/M codes for newborns with the same number of days in the NICU, Mednax newborns had, on average, 0.60 to 0.62 additional intensive or critical care codes instead of newborn or hospital care codes in the NICU, compared to non-Mednax newborns with the same number of days in the NICU (columns [5] and [3] of Table 7, respectively). Again, 0.60 additional intensive or critical care codes in the NICU is likely to be a lower bound if diagnoses were influenced by Mednax in the NICU.[87] The finding that Mednax newborns who stayed the same number of days in the NICU as non-Mednax newborns had, on average, a higher number of intensive or critical care codes also aligns with the descriptive statistics in Section VI.

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87 When combined with the effect of more days in the NICU, this results in an overall effect of 1.84 to 2.35 additional intensive or critical care codes, on average, over non-Mednax newborns in the NICU; see columns [3]-[5] of Table 5 above.

Table 6: Mednax Newborns Had, on Average, Longer Stays in the NICU than Non-Mednax Newborns

	Without Controls [1]	Birth Charac. Only [2]	Charac. Known Prior to NICU Stay [3]	All Charac. Except Dx [4]	All Charac. Including Dx [5]
Avg. Difference between Mednax and Non-Mednax	5.152***	2.030***	1.773***	1.338***	1.308***
	(0.431)	(0.167)	(0.159)	(0.159)	(0.151)
<u>Controls included in the model:</u>					
Birth characteristics		Y	Y	Y	Y
Hospital characteristics			Y	Y	Y
Zip-code demographics			Y	Y	Y
State-year time trends			Y	Y	Y
Facility resource usage				Y	Y
Diagnoses during hospital stay					Y
Number of observations	127578	127578	127578	127578	127578
Number of clusters (hospitals)	2186	2186	2186	2186	2186

Notes: Standard errors are clustered by hospital where the newborn received care in the NICU. The unit of observation is a newborn's episode in the NICU (revenue codes 172-174 and 200-209). The outcome is the number of calendar days in the NICU. The "Avg. Difference between Mednax and Non-Mednax" is the coefficient estimate on the Mednax indicator, which equals one if all E/M codes in the NICU were billed by Mednax. The comparator group includes all newborns in the NICU cared for by non-Mednax providers who meet the criteria for the final sample (see Section V.D) in Aetna's claims dataset. See Appendix E, Section A for a complete list of controls. "Dx" stands for diagnoses, and "Y" stands for yes. ***p<0.01, **p<0.05, *p<0.10

Table 7: Comparing Newborns Who Stayed the Same Number of Days in the NICU, Mednax Newborns Had, on Average, More Higher-Severity E/M Codes Instead of Lower-Severity E/M Codes than Non-Mednax Newborns

	Without Controls [1]	Birth Charac. Only [2]	Charac. Known Prior to NICU Stay [3]	All Charac. Except Dx [4]	All Charac. Including Dx [5]
Avg. Difference between Mednax and Non-Mednax	0.750***	0.652***	0.624***	0.607***	0.596***
	(0.0679)	(0.0668)	(0.0715)	(0.0709)	(0.0738)
<u>Controls included in the model:</u>					
Number of days in the NICU	Y	Y	Y	Y	Y
Birth characteristics		Y	Y	Y	Y
Hospital characteristics			Y	Y	Y
Zip-code demographics			Y	Y	Y
State-year time trends			Y	Y	Y
Facility resource usage				Y	Y
Diagnoses during hospital stay					Y
Number of observations	127578	127578	127578	127578	127578
Number of clusters (hospitals)	2186	2186	2186	2186	2186

Notes: Standard errors are clustered by hospital where the newborn received care in the NICU. The unit of observation is a newborn's episode in the NICU (revenue codes 172-174 and 200-209). The outcome is the number of intensive or critical care codes billed in the NICU. The "Avg. Difference between Mednax and Non-Mednax" is the coefficient estimate on the Mednax indicator, which equals one if all E/M codes in the NICU were billed by Mednax. The comparator group includes all newborns in the NICU cared for by non-Mednax providers who meet the criteria for the final sample (see Section V.D) in Aetna's claims dataset. See Appendix E, Section A for a complete list of controls. "Dx" stands for diagnoses, and "Y" stands for yes. ***p<0.01, **p<0.05, *p<0.10

68. The results in this section show that the differences in the number of intensive or critical care codes billed for Mednax and non-Mednax newborns are robust to controlling for numerous potentially confounding factors.

VIII. DIFFERENCES IN THE NUMBER OF INTENSIVE OR CRITICAL CARE CODES FOR MEDNAX NEWBORNS RELATIVE TO NON-MEDNAX NEWBORNS ARE CONSISTENT ACROSS NUMEROUS TESTS OF ALTERNATIVE EXPLANATIONS

69. The results in Section VII above show that Mednax billed more intensive or critical care codes for newborns in the NICU than non-Mednax providers even after accounting for potential confounders such as health risks, hospital characteristics, and state-specific time trends. To address potential criticisms of the specific approach that I utilize in Section VII, I run numerous tests for alternative explanations, and I refer to these tests as "robustness checks." In Sections VIII.A and VIII.B, I describe two robustness checks in particular: (a) comparator groups that would serve as alternatives to all non-

Mednax newborns covered by Aetna and (b) a "case study" of newborns in the NICU who received care at hospitals in Texas. I provide a high-level summary of additional robustness checks in Section VIII.C, and the results of these robustness checks are enclosed in Appendix F. Across all robustness checks, I consistently find that Mednax newborns in the NICU were, on average, billed more intensive or critical care codes than non-Mednax newborns in the NICU.[88]

70. These robustness checks are not meant to be exhaustive, and if Mednax's experts raise additional critiques, I reserve the right to supplement my analysis and testimony in response.

A. Alternative Comparator Groups

71. My main results compare all Mednax and non-Mednax newborns in the NICU who were covered by Aetna between January 2009 and February 2019 and who meet the criteria described in Section V.D. A potential critique could arise if some non-Mednax providers are seen as not comparable to Mednax providers because, for example, they practice in lower-tiered hospitals than Mednax providers. To address these considerations, I run my analysis with two alternative comparator groups: (1) non-Mednax newborns who received care at hospitals with at least one NICU bed as reported to CMS[89] ("HCRIS comparator group") and (2) non-Mednax newborns who received care at one of the top 50 neonatology hospitals according to the 2020 U.S. News & World Report ranking ("ranked comparator group"). The HCRIS comparator group includes 63.1 percent of all non-Mednax newborns in the final regression sample, and the ranked comparator group includes 9.3 percent of non-Mednax newborns in the final sample.

72. Table 8 shows the results across comparator groups when I analyze the overall difference between Mednax and non-Mednax newborns in the number of intensive or

[88] In my report, I focus on robustness checks of the overall difference in the number of intensive or critical care codes billed by Mednax in the NICU. Robustness checks pertaining to longer stays in the NICU and substitution from lower to higher severity E/M codes are included in Appendix F.

[89] I identify hospitals with NICU beds using CMS' HCRIS dataset for 2017. See Appendix C, Section C for details.

critical care codes billed in the NICU. Each panel reflects the results when I compare Mednax newborns with non-Mednax newborns in the specified comparator group. The results in Panel A are identical to the results presented in Table 5 above. For every comparator group and set of controls included in the model, Mednax newborns in the NICU had, on average, more intensive or critical care codes than non-Mednax newborns in the NICU. The estimate of the Mednax differential is slightly smaller in magnitude when I compare Mednax newborns with non-Mednax newborns in the HCRIS comparator group (Panel B). The Mednax differential is larger in magnitude than the base case of all non-Mednax newborns when I compare Mednax newborns with non-Mednax newborns in the ranked comparator group (shown in Panel C). Altogether, the results consistently demonstrate that Mednax billed more intensive or critical care codes in the NICU.

Table 8: Across Comparator Groups, Mednax Newborns in the NICU Had More Intensive or Critical Care Codes than Non-Mednax Newborns in the NICU

	Without Controls [1]	Birth Charac. Only [2]	Charac. Known Prior to NICU Stay [3]	All Charac. Except Dx [4]	All Charac. Including Dx [5]
Panel A. Comparator Group: All Non-Mednax Newborns Covered by Aetna					
Avg. Difference between Mednax and Non-Mednax	5.911***	2.625***	2.349***	1.899***	1.841***
	(0.442)	(0.187)	(0.186)	(0.180)	(0.175)
Number of observations	127578	127578	127578	127578	127578
Number of clusters	2186	2186	2186	2186	2186
Panel B. Comparator Group: Hospitals with NICU Beds as Reported in HCRIS					
Avg. Difference between Mednax and Non-Mednax	4.904***	2.241***	1.994***	1.726***	1.756***
	(0.480)	(0.197)	(0.228)	(0.228)	(0.214)
Number of observations	93505	93505	93505	93505	93505
Number of clusters	1088	1088	1088	1088	1088
Panel C. Comparator Group: Top Ranked Neonatology Hospitals					
Avg. Difference between Mednax and Non-Mednax	2.478**	1.782***	1.786***	2.307***	2.524***
	(0.996)	(0.363)	(0.476)	(0.529)	(0.399)
Number of observations	43877	43877	43877	43877	43877
Number of clusters	552	552	552	552	552

Notes: Standard errors are clustered by hospital where the newborn received care in the NICU. The unit of observation is a newborn's episode in the NICU (revenue codes 172-174 and 200-209). The outcome is the number of intensive or critical care codes billed in the NICU. The "Avg. Difference between Mednax and Non-Mednax" is the coefficient estimate on the Mednax indicator, which equals one if all E/M codes in the NICU were billed by Mednax. The comparator group in Panel A includes all newborns in the NICU cared for by non-Mednax providers who meet the criteria for the final sample (see Section V.D) in Aetna's claims dataset. The comparator group in Panel B includes newborns cared for by non-Mednax providers at hospitals with at least one NICU bed as reported to the 2017 CMS HCRIS. The comparator group in Panel C includes newborns cared for by non-Mednax providers at the top 50 neonatology hospitals according to the 2020 U.S. News & World Report rankings. "Dx" stands for diagnoses. See Appendix E, Section A for a complete list of controls. Column [1] does not include controls in addition to the Mednax indicator. Column [2] includes controls for birth characteristics. Column [3] includes controls for birth characteristics, hospital characteristics, zip-code demographics, and state-year fixed effects. Relative to the model in column [3], column [4] additionally includes controls for facility resource usage during the episode. Column [5] includes all controls, including diagnoses entered during the episode. ***p<0.01, **p<0.05, *p<0.10

B. TEXAS CASE STUDY

73. I also analyze the fact that states vary in regulatory and legal environments such that provider billing may differ from state to state. To address this concern, I analyze newborns who received care in hospitals in Texas, where 36.5 percent of Mednax newborns with stays in the NICU and covered by Aetna were located. Advantages of the Texas-only study include:

   a. All hospitals in Texas are subject to the same regulatory and legal environment. While my main analysis in Table 5 controls for state-specific

trends, restricting the sample to Texas-only assures that differences across states in regulatory structure do not drive the results.

b. I was able to collect more refined information on NICU levels and number of NICU beds for Texas hospitals from the AAP's NICU Search webpage and to match these hospitals to Aetna's claims data.[90]

74. The results of the Texas-specific models are shown in Table 9. The top panel corresponds to results across Mednax and non-Mednax newborns in my final sample who received care in the NICU at a facility in Texas. The bottom panel corresponds to results among newborns at AAP level III or level IV facilities. Approximately 73 percent of Mednax newborns and 56 percent of non-Mednax newborns who received care in the NICU in a Texas facility were cared for at an AAP level III or level IV facility. The results range from 1.52 to 1.74 additional intensive or critical care codes for Mednax newborns relative to non-Mednax newborns among Aetna newborns in Texas (columns [3]-[5] in Panel A) and 1.70 to 1.95 additional intensive or critical care codes for Mednax newborns relative to Non-Mednax newborns among Aetna newborns in AAP level III or level IV facilities in Texas (columns [3]-[5] in Panel B). The Texas results confirm that Mednax newborns in the NICU were billed more intensive or critical care codes than non-Mednax newborns in the NICU and that the results are not driven by differences in state-specific regulations or requirements.

90 American Academy of Pediatrics, NICU Search, https://www.aap.org/en-us/advocacy-and-policy/aap-health-initiatives/nicuverification/Pages/NICUSearch.aspx (data extracted on July 10, 2020).

Table 9: Number of Additional Intensive or Critical Care Codes Billed by Mednax Among Newborns in the NICU in Texas

	Without Controls [1]	Birth Charac. Only [2]	Charac. Known Prior to NICU Stay [3]	All Charac. Except Dx [4]	All Charac. Including Dx [5]
Panel A. Aetna Newborns in TX					
Avg. Difference between Mednax and Non-Mednax	5.737***	2.039***	1.678***	1.744***	1.517***
	(1.010)	(0.271)	(0.276)	(0.278)	(0.229)
Number of observations	23153	23153	23153	23153	23153
Number of clusters	219	219	219	219	219
Panel B. Aetna Newborns in AAP Levels III/IV Facilities in TX					
Avg. Difference between Mednax and Non-Mednax	6.153***	2.413***	1.946***	1.820***	1.701***
	(1.357)	(0.333)	(0.335)	(0.376)	(0.311)
Number of observations	15145	15145	15145	15145	15145
Number of clusters	83	83	83	83	83

Notes: Standard errors are clustered by hospital where the newborn received care in the NICU. The unit of observation is a newborn's episode in the NICU (revenue codes 172-174 and 200-209). The outcome is the number of intensive or critical care codes billed in the NICU. The "Avg. Difference between Mednax and Non-Mednax" is the coefficient estimate on the Mednax indicator, which equals one if all E/M codes in the NICU were billed by Mednax. The results in Panel A are based on all newborns in the NICU cared for by Mednax and non-Mednax providers in the state of Texas who meet the criteria for the final sample (see Section V.D) in Aetna's claims dataset. The results in Panel B are based on newborns in the NICU cared for by Mednax and non-Mednax providers at hospitals in Texas that are designated as AAP level III or IV facilities. "Dx" stands for diagnoses. See Appendix E, Section A for a complete list of controls. Column [1] does not include controls in addition to the Mednax indicator. Column [2] includes controls for birth characteristics. Column [3] includes controls for birth characteristics, hospital characteristics, zip-code demographics, and state-year fixed effects. Relative to the model in column [3], column [4] additionally includes controls for facility resource usage during the episode. Column [5] includes all controls, including diagnoses entered during the episode. ***p<0.01, **p<0.05, *p<0.10

C. Summary of Additional Robustness Checks

75. In addition to conducting robustness checks with alternative comparator groups and a Texas-focused case study, I run numerous tests (accounting for all potential confounders in the model as shown in column [5] of Table 5) for other possible explanations of the Mednax differential such as:

a. I include level II-IV nursery care in my definition of NICU, and a critique may be that newborns receiving level II nursery care receive systematically different services by physicians than newborns receiving level III or level IV nursery care. I run a robustness check in which I only include newborns who received level III or level IV nursery care on their first day in the NICU. My conclusions remain unchanged—Mednax newborns in the NICU were billed,

on average, 2.14 additional intensive or critical care codes relative to non-Mednax newborns (see column [3] of Table 16 in Appendix F).

b. Another critique may be that I omit controls for maternal health risks that affect the newborn's care in the NICU. I conduct a robustness check that includes controls for maternal health risks based on diagnoses identified in peer-reviewed studies.[91] Even after accounting for maternal health risks, I find that Mednax newborns in the NICU were billed, on average, 1.83 more intensive or critical care codes than non-Mednax newborns (see column [6] of Table 16 in Appendix F).

c. Another potential explanation for the Mednax differential is that non-Mednax newborns were disproportionately more likely to be NICU observation stays, as opposed to NICU stays, and that these short observation stays are driving the results. I conduct a robustness check where I exclude all NICU stays that are one day in duration. The results continue to show that Mednax newborns in the NICU were billed, on average, 1.94 additional intensive or critical care codes than non-Mednax newborns in the NICU (see column [10] of Table 16 in Appendix F).

76. The full set of results of robustness checks are enclosed in Appendix F. Table 16 presents the results of robustness checks when I analyze the overall difference in the number of intensive or critical care codes billed in the NICU by Mednax compared with non-Mednax providers. Table 17 summarizes the results of the robustness checks when I analyze differences in the number of days in the NICU between Mednax and non-Mednax newborns. Lastly, Table 18 shows the results of robustness checks when I test for substitution from lower-severity codes to higher-severity codes in the NICU. The results across the robustness checks in the three tables support the results of my main analysis: Mednax newborns in the NICU were billed, on average, more intensive or critical care codes than non-Mednax newborns, and the overall difference is driven

91 Specifically, I use diagnoses associated with maternal health risks listed in X Xu et al., "Hospital variation in cost of childbirth and contributing factors: a cross-sectional study," *BJOG* 215 (2018): 829-839.

by both longer stays in the NICU and substitution away from lower-severity newborn and hospital care codes towards higher-severity intensive and critical care codes in the NICU.

77. Whereas the robustness checks described above focus on the linear regression model, I also run a non-linear count model to test whether the results are driven by modeling assumptions regarding functional form. Count models, including the Poisson model that is shown in Equation 2 of Section B in Appendix E, are a standard approach in the economics literature to model counts such as the number of doctor visits per person.[92] Results from the Poisson model also show that, on average, Mednax newborns in the NICU were billed more intensive or critical care codes relative to non-Mednax newborns, and the estimated overall difference is 2.26 per episode (see Table 15 of Appendix E, Section B).

IX. MEDNAX WAS MORE LIKELY TO BILL INTENSIVE AND CRITICAL CARE CODES AT THE START OF THE NEWBORN'S STAY IN THE NICU AND LESS LIKELY TO "STEP DOWN" AT THE END OF THE NICU STAY

78. In this section, I analyze episodes where Mednax billed higher-severity codes instead of lower-severity codes to understand whether its coding patterns in these episodes differ from those of non-Mednax providers. Specifically, I assess a) whether Mednax was more likely to code intensive or critical codes at the onset of the episode in the NICU; and b) whether Mednax was less likely to "step down" from an intensive or critical care code to a newborn of hospital care code at the end of the episode in the NICU. The evidence suggests that Mednax billed more higher-severity codes at the start of the episode and fewer lower-severity codes at the end of the episode.

79. The shares of Mednax or non-Mednax newborns with newborn/hospital, intensive, or critical care codes as the first E/M code in the NICU are summarized in Table 10. Column [3] of Table 10 is the difference between Mednax (column [1]) and non-Mednax (column [2]) shares. These shares are not adjusted for differences in the underlying characteristics of the newborns or hospitals. Column [4] estimates this same

[92] A. Colin Cameron and Pravin K. Trivedi, *Microeconometrics Using Stata, Revised Edition*, (College Station, TX: Stata Press Publication, 2010), Chapter 10.

difference in shares between Mednax and non-Mednax newborns using econometric analyses that control for potential confounders, such as differences in the newborn's health risk prior to receiving care in the NICU. The results are similar between column [3] (without accounting for potential confounders) and column [4] (with controls for potential confounders).[93] Mednax was 11.4 to 13.5 percentage points more likely to bill an intensive care code and 1.7 to 6.0 percentage points more likely to bill a critical care code at the start of the newborn's stay in the NICU. Mednax was less likely to bill newborn or hospital care codes at the start of the newborn's stay in the NICU.

Table 10: Share of Mednax and Non-Mednax Newborns by First E/M Code Billed in the NICU

	Not Accounting for Potential Confounders			Accounts for Confounders	
	Mednax	Non-Mednax	Diff: Med - Non	Avg. Marginal Effect	
	[1]	[2]	[3]=[1]-[2]	[4]	
Newborn or Hospital Care	3.8%	21.2%	-17.4%	-16.2%	***
Intensive Care	49.9%	38.5%	11.4%	13.5%	***
Critical Care	46.3%	40.4%	6.0%	1.7%	

Notes: Sample of newborns included in the analysis consists of newborns who meet the criteria laid out in Section V.D, and who spent more than 1 day in the NICU. For these non-linear models to solve (converge), the sample focuses on newborns in states with at least 1 Mednax episode between 2009 and 2019 and excludes 4 states or territories where there were 6 Mednax episodes or fewer throughout the period. "Avg. Marginal Effect" is the average marginal effect across episodes as predicted by the models; see Appendix E, Section C for details. Standard errors are clustered by hospital. ***p<0.01, **p<0.05, *p<0.10

80. To analyze whether Mednax was also less likely to step down at the end of the newborn's stay in the NICU, I sort newborns into three groups based on the pattern of codes during the episode. These groups are: (1) same code category as the first code across all following days; (2) last code in the NICU was a lower-severity code than the first code; or (3) all remaining patterns. For newborns who had a critical care code as their first code in the NICU, I further split the second group between newborns with a last code of intensive care and newborns with a last code of newborn or hospital care in the NICU. The tabulations and regression model results are shown in Table 11. Table 11 restricts to newborns for whom the first E/M code billed in the NICU was an

[93] I use logit regression models to analyze the outcomes in this section. See Appendix E, Section C for details about my model choice and specification.

intensive or critical care code; for Mednax, this represents 95 percent of newborns in the NICU.

Table 11: Share of Newborns by Coding Pattern in the NICU

		Not Accounting for Potential Confounders			Accounts for Confounders	
		Mednax [1]	Non-Mednax [2]	Diff: Med - Non [3]=[1]-[2]	Avg. Marginal Effect [4]	
Panel A. Among newborns with an **intensive** care code at the start of the NICU stay:						
[A]	All codes in the NICU were intensive	87.8%	76.0%	11.8%	10.1%	***
[B]	Last code in the NICU was newborn/hospital	4.9%	17.7%	-12.8%	-12.0%	***
Panel B. Among newborns with a **critical** care code at the start of the NICU stay:						
[C]	All codes in the NICU were critical	3.3%	6.7%	-3.5%	-1.9%	***
[D]	Last code in the NICU was intensive	93.2%	78.8%	14.4%	13.4%	***
[E]	Last code in the NICU was newborn/hospital	3.4%	13.8%	-10.4%	-12.4%	***

Notes: Sample of newborns included in the analysis consists of newborns who meet the criteria laid out in Section V.D, who spent more than 1 day in the NICU, and whose first code in the NICU was an intensive care code (Panel A) or critical care code (Panel B). For these non-linear models to solve (converge), the sample focuses on newborns in states with at least 1 Mednax episode between 2009 and 2019 and excludes 4 states or territories where there were 6 Mednax episodes or fewer throughout the period. "Avg. Marginal Effect" is the average marginal effect across episodes as predicted by the regression models; see Appendix E, Section C for details. Standard errors are clustered by hospital. ***p<0.01, **p<0.05, *p<0.10

81. As seen in Table 11, Mednax was less likely to bill a newborn or hospital care code as the last E/M code in the NICU regardless of the first code that was billed in the NICU:

   a. For newborns with an intensive care code at the start of the NICU stay in Panel A, the difference is around 12.0 to 12.8 percentage points (see row [B]). Instead, Mednax was more likely to consistently bill intensive care codes throughout the newborn's stay in the NICU.

   b. For newborns with a critical care code at the start of the NICU stay in Panel B, the difference is 10.4 to 12.4 percentage points (see row [E]).

82. These patterns are consistent with the descriptive statistics in Figure 5 showing that only intensive and critical care codes were billed for most Mednax newborns.

X. CONCLUSION

83. My statistical analyses consistently show that Mednax providers billed a higher number of intensive or critical care codes for newborns in the NICU than non-Mednax providers. This result is not surprising given that Mednax exclusively billed intensive

or critical care codes for 88.0 percent of newborns under their care in the NICU; for newborns who spent more than 3 days in a similar setting, Mednax exclusively billed intensive or critical care codes for 88.9 to 96.3 percent of newborns depending on the number of days that the newborn spent in the NICU. The data and evidence show that Mednax rarely billed any of the lower-severity E/M codes for newborns in the NICU, even prior to the newborn's discharge.

84. The Mednax differential in the number of intensive or critical care codes billed in the NICU can be decomposed into two effects: (1) Mednax newborns had longer stays in the NICU and (2) Mednax newborns were billed more intensive or critical care codes rather than newborn or hospital care codes. I find evidence of both effects, and these results are robust to alternative explanations and modeling choices.

85. To assess when Mednax providers billed for intensive or critical care codes instead of hospital or newborn care codes, I analyze the pattern of E/M billing across days within an episode. The results indicate that Mednax providers were more likely to bill intensive or critical care codes on the first day in the NICU and also less likely to bill a hospital or newborn care code on the last day in the NICU.

Respectfully Submitted,

Josephine I. Duh
October 26, 2020

APPENDIX A – CV

Dr. Josephine Duh is a Senior Associate in the Competition and Healthcare & Life Sciences Practices at The Brattle Group with experience working on economic analyses, damages, and econometric modeling, particularly in the Healthcare & Life Sciences industries.

In her casework, she has testified in federal court as a summary witness in a class action lawsuit alleging wrongful denials of mental health and substance use disorder claims, and she has supported experts on cases concerning alleged anticompetitive behavior, fraud, economic damages, and patent infringement. She specializes in analyzing industry data, particularly healthcare claims and prescriptions data, and developing econometric models to assess liability and damages. At Brattle, she has also worked with utility companies to develop forecasting models using econometric tools. Prior to joining the firm, Dr. Duh studied community effects of global health interventions in developing countries.

Dr. Duh holds a Ph.D. in Economics from Princeton University and a B.S. in Economics from MIT.

EDUCATION

Ph.D., Economics, Princeton University, 2014
M.A., Economics, Princeton University, 2010
B.S., Economics, Massachusetts Institute of Technology, 2008

AREAS OF EXPERTISE

- Complex litigation in Healthcare and Life Sciences
- Economic damages
- Econometric modeling and forecasting

EXPERIENCE

Testimony

- **Provided summary witness testimony in *Alexander et al. v. United Behavioral Health (3:14-cv-05337)*/*Wit et al. v. United Behavioral Health (3:14-cv-02346)*.** Reviewed health plan provisions and denial letters related to mental health and substance use disorders services for ERISA lawsuit alleging wrongful denial of claims. Developed exhibits to summarize terms in plans and letters/case notes. Provided live testimony in the U.S. District Court in the Northern District of California San Francisco Division.

Alleged Anticompetitive Conduct in Healthcare and Life Sciences

- **Analyzed Arguments of Alleged Collusion in Buyer Market.** Supported an economics expert on arguments of alleged collusion between employers in a

medical setting. Expert's testimony discussed the economic theory of collusive agreements and assessed evidence from the case record of alleged collusive behavior in the labor market.

- **Analyzed Competitive Effects of Alleged Disparagement of Medical Professional.** Analyzed the market for tertiary care in a U.S. metropolitan area. Evaluated the claim that an alleged disparagement campaign slowed diffusion of medical technology and harmed competition. Analysis involved assessing patient flow and supply of medical service throughout the damages period.
- **Analyzed Allegation of Monopolization of ER Services.** Analyzed ambulance trips, Emergency Room visits, and hospital financial information to evaluate claim of monopolization of ER services by a teaching hospital in a Mid-Western state and to calculate lost profits.
- **Estimated Damages from Hospital Acquisition of Physician Specialty Groups.** Analyzed the impact of alleged monopolistic behavior by a health system after it had acquired physician specialty groups in the local market. Demonstrated the relevant product and geographic market for services. Calculated damages using hospital-billing data that were collected by the state.
- **Assessed Economic Consequences of Exclusivity Provisions in Contract between Medical Device Companies.** Supported an expert on the economic principles behind exclusivity provisions in contracts between independent parties, particularly in the context of medical devices.

Economic Impacts and Damages in Healthcare and Life Sciences

- **Assessed Damages for Alleged Kickbacks in *U.S. ex rel. Bilotta v. Novartis* (No. 11 Civ. 0071 (PGG)).** Developed econometric models to analyze effects of alleged kickbacks on prescribing behavior and calculated damages across Medicare Part D, Medicaid, and TRICARE. Supported experts on economic analysis and data preparation, including construction of alleged kickback metrics based on the manufacturer's marketing events database.
- **Analyzed Economic Returns on Acquisition of Pharmacy Benefit Manager in *Anthem, Inc. v. Express Scripts, Inc.* (Civil Action No. 16 Civ. 2048).** Supported expert to estimate returns on the acquisition of a Pharmacy Benefit Manager ("PBM") and the parties' subsequent agreement for the provision of PBM services. Assessed transaction by critically reviewing financial records and internal valuation models and calculating both expected and realized returns.

- **Estimated Proof of Claims on Behalf of a Group of States in the Purdue Pharma Bankruptcy.** Estimated historical and projected economic costs of the opioid epidemic to state governments, including federal disbursements. Worked with state attorney offices and state agencies to collect and synthesize information on costs of opioid-related abatement programs and departments impacted by the opioid epidemic. Developed forecasts of state populations with opioid use disorder and program expenditures.
- **Evaluated Economic Impacts of a Proposed Surcharge on the Market for Opioids in *Healthcare Distribution Alliance v. Howard A. Zucker, in his official capacity as Commissioner of Health of New York; and Barbara D. Underwood, in her official capacity as the Attorney General of New York* (No. 1:18-cv-06168-KPF).** Supported an expert in pharmaceutical economics on the impact of state legislation on opioids. Analyzed the implications of the legislation on the state and national market for the drugs, anticipated responses of parties in the supply chain, and cross-state pricing effects.
- **Assessed Liability Claims in a SEC Rule 10b-5 Class Action Alleging Misrepresentations by Healthcare Provider.** Evaluated whether the alleged misrepresentations of industry metrics by a fast-growing healthcare provider overstated revenue and understated risk of bad debt. Worked with an academic expert in health economics to analyze evidentiary record on claims related to provider reimbursement and market competition.
- **Estimated Damages from Patent Infringement in the Medical Devices Industry.** Analyzed financial information for two medical devices companies to estimate incremental profits related to infringed products. Reviewed license and royalty agreements. Calculated reasonable royalties for patent infringement using sales and financial data.
- **Calculated Avoided Costs and Administrative Revenue for Allegedly Wrongfully Denied Health Claims/Requests in ERISA Lawsuit.** Analyzed authorizations data and paid & denied claims data from a large health insurer to calculate avoided costs and administrative revenue associated with denials of authorization requests and/or claims.

Assessment of Economic Damages

- **Estimated Damages from Mortgage Servicing Failures.** Developed models to assess and quantify impact of mortgage servicing failures on borrowers including opportunity costs and costs from additional adverse credit events, such as foreclosure. Processed large volumes of loan performance and credit reporting

data. Estimated econometric model to measure increase in probability of foreclosure initiation.

- **Estimated Damages from Trademark Infringement in Sports Equipment.** Conducted a hypothetical negotiation analysis to construct a range of reasonable royalty rates for alleged trademark infringement in the sports equipment industry. Analyzed company sales data, financials, and marketing surveys.
- **Estimated Damages from False Advertising in Consumer Products.** Analyzed the impact of media coverage of allegedly erroneous research on demand for a consumer product. Opposing sides claimed that the other party had promoted research that was scientifically unfounded. Critically assessed methods of measuring media coverage for damages calculation.
- **Estimated Damages from Environmental Disaster.** Analyzed the impact of a large-scale environmental disaster on recreational activities. The approach included developing cumulative visitation from point-in-time counts and estimating impacts using econometric techniques.

Econometric Modeling and Forecasting

- **Developed Models for Forecasting Electricity Sales: Public Service Company of New Mexico.** Reviewed demand-forecasting models for Residential and Commercial classes. Assessed methodology to integrate utility-sponsored Energy Efficiency programs and Codes & Standards into forecast. Re-estimated models for eight rate classes comprising four-fifths of total electricity sales. Supported expert testimony for rate case.
- **Conducted Comprehensive Review of a Suite of Forecasting Models: A Leading Electric Utility Company in Australia.** Reviewed demand, supply, and price forecasting models of National Electricity Market for one of the largest integrated utility companies in Australia. Developed short- and long-term recommendations to address key areas of uncertainty including penetration of distributed generation, shifts in the structure of the Australian economy, and strategic bidding behavior among wholesale suppliers.
- **Developed Model for Forecasting Electricity Sales in the Agricultural Industry for a Large Utility Company in the United States.** Conducted background research on trends in agriculture that may influence sales and reviewed agricultural energy sales forecast models from literature and industry. Specified and vetted econometric models to predict long-term sales. Tested sensitivities to uncertainty in model structure and forecasted inputs.

PROFESSIONAL AFFILIATIONS

American Economic Association, American Society of Health Economists, American Bar Association, American Health Lawyers Association

ACADEMIC HONORS AND FELLOWSHIPS

2018	Co-winner of The Austin Robinson Memorial Prize with Dean Spears for the "best non-solicited paper published in The Economic Journal by an author who has completed their PhD in the last five years"
2013	Graduate Research Grant for Global Health and Infectious Disease, Center for Health and Wellbeing, Princeton University; Graduate Research Grant, Griswold Center for Economic Policy Studies, Princeton University
2011, 2012	Towbes Prize for Outstanding Teaching, Princeton University
2008-2013	Princeton University Graduate Fellowship, Princeton University
2007	Patrick J. McGovern '59 Entrepreneurship Award, MIT

PUBLICATIONS

"**Health and Hunger: Disease, Energy Needs and the Indian Calorie Consumption Puzzle**" with Dean Spears, *The Economic Journal*, 27 April 2017, DOI: 10.1111/ecoj.12417.

"Overcoming the Over-Forecasting Bias of Pure Econometric Models: A Utility Case Study" with Ahmad Faruqui, *Electricity Policy*, February 2017.

"Curating the Future of Rate Design for Residential Customers" with Ahmad Faruqui, Wade Davis, and Cody Warner, *Electricity Policy*, July 2016.

PRESENTATIONS

"Impact of Low Load Growth and Increased Energy Efficiency"
October 15, 2015
Josephine Duh and Ahmad Faruqui
Presented at the Indiana Energy Conference 2015, Indianapolis, IN

"A Template for Designing the Optimal Tariff for Residential Customers"
June 26, 2015
Ahmad Faruqui, Ryan Hledik, and Josephine Duh
Presented at the 28th Annual Western Conference, Center for Research in Regulated Industries, Rutgers University, Monterey, CA

"Re-examining the Controversial Rebound Effect in Energy Efficiency"
June 25, 2015
Josephine Duh and Ahmad Faruqui
Presented at the 28th Annual Western Conference, Center for Research in Regulated Industries, Rutgers University, Monterey, CA

“Health and Hunger: Disease, Energy Needs and the Indian Calorie Consumption Puzzle”
May 1, 2015
Josephine Duh and Dean Spears
Presented at the Population Association of America Annual Meeting, San Diego, CA

“AIDS Treatment and Child Schooling in Sub-Saharan Africa”
April 29, 2015
Josephine Duh
Presented at the Population Association of America Annual Meeting, San Diego, CA

APPENDIX B – MATERIALS RELIED UPON

A. Case Documents

2019.03.18 Identification of Practice Groups.pdf
Complaint, Aetna Inc., et al. v. Mednax, Inc., et al., Civil No. 01040, April 25, 2018
Deposition Transcript of Laurel Klink, June 12, 2020
Deposition Transcript of Robert Bryant, August 5, 2020
Deposition Transcript of Richard Harris, May 11, 2020
Phone call with Dr. Evans on October 7, 2020
Table 5 and Appendix D of Expert Report of Michael I. Cragg, Ph.D., October 26, 2020

B. Bates Stamped Documents

AETNA 1385-1424
Aetna 17648_AEO_CJ31_CLMC.TXT
Aetna_17649_AEO_CJ31_GRPB.TXT
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Aetna_17651_AEO_CJ31_PRVE.TXT
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Aetna Conf 46896 ewhprd_global_lookup.xlsx
Aetna Conf 46887 Data Dictionary crosswalk.xlsx
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U.S. Census Bureau's 2013 and 2019 TIGER/Line Shapefiles. https://www.census.gov/geographies/mapping-files/time-series/geo/tiger-line-file.html.

Zipinfo.com. "County-Zip Code Database." https://www.zipinfo.com/products/cz/cz.htm.

D. ACADEMIC LITERATURE

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E. PUBLIC FILINGS

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Mednax, Inc. Form 10-K for the Fiscal Year Ended December 31, 2009. Accessed July 14, 2020.

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APPENDIX C – DATA PREPARATION

A. VARIABLES CONSTRUCTED FROM CLAIMS DATA

86. As discussed in Section V, my primary source of data is the Aetna claims data. In this section, I describe the steps I perform to prepare the data for my analyses. Based on my experience working with claims data (including claims data for government programs), these steps taken to work with the data are reasonable and expected, and I find it reasonable to rely upon the data in performing my analysis.

1. Claims Included in the Analysis

87. As an initial step, I limit the universe of claims analyzed to those that occur in an inpatient setting and are not coded as "denied" or "duplicate" in the raw data. I also limit my analysis to just the final action taken for claims and remove intermediate versions that appear to be present for some of the claims. I do this by excluding all sets of claim lines that have a reversal, identified by grouping claim lines that are billed to the same member for the same service on the same date with the same unique claim identifier, but have the opposite, non-zero billed amounts. My accompanying workpapers detail these steps, including the reversal identification steps.

2. Identification of Episodes of Care

88. As I discuss above in Section V, I perform my analyses at the episode level. Here I describe how I identify episodes of care and include these episodes in my analyses. As with the other areas of my analysis, my workpapers provide complete details for how I execute each of these steps.

a) General identification

89. To start, I identify the date ranges of a given patient's hospitalization by analyzing sequential groups of inpatient care days that have at least one accommodation revenue code and/or at least one "attendance" at delivery, "resuscitation" at delivery, newborn care, hospital care, intensive care, critical care, or discharge CPT code billed. Generally, I identify the end date of an inpatient episode when I observe either of the following among the inpatient claims data for a patient: a discharge code and one day

gap; or any two day gap and any subsequent inpatient days from a separate hospitalization event. Then, for every member, for every hospitalization date range, I define an episode of care to be the set of all valid claim lines that were billed to the member and fall in the date range.

b) Identification of newborns

90. The claims data also includes claims related to the mother's care, and to identify claims pertaining to *newborns*, I consider every MEMBER_ID that satisfies all four of the following criteria: (1) has a birth date of January 1, 2009 or later, as identified by MEMBER_BIRTH_DATE field, (2) has at least one claim in the data with a birth ICD-9 or ICD-10 diagnosis code (V30-V39 and Z38.0-Z38.9), (3) does not have a claim with a delivery ICD-9 or ICD-10 diagnosis code (V27.0-V27.9 and Z37.0-Z37.9), and (4) has at least one nursery claim (revenue code 170-179).

91. The data includes some MEMBER_IDs where a single identifier contains claims for both the mother and the newborn. I separate these mixed claims into mother-specific and newborn-specific claims based on diagnosis codes identified by CMS[94] as pertaining to only the maternal or only the newborn record and CPT codes that are either newborn-specific or for prenatal visits.[95]

92. If a claim has any maternal-only codes and no newborn-only codes, it is classified as the mother's claim. Similarly, if the claim has any newborn-only codes and no maternal-only codes, it is classified as the newborn's claim. Members with ambiguous

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[94] See "Definitions of Medicare Code Edits," Centers for Medicare and Medicaid Services, March 2012, https://www.cms.gov/Medicare/Coding/ICD10/downloads/icd10_mce27_user_manual.pdf (last viewed on October 14, 2020) for ICD-9 codes, Centers for Medicare and Medicaid Services and "Definitions of Medicare Code Edits v31.0," Centers for Medicare and Medicaid Services, October 2013, https://www.cms.gov/medicare/medicare-fee-for-service-payment/acuteinpatientpps/downloads/fy_14_definition_of-medicare_code_edits_v_31_manual.pdf (last viewed on October 14, 2020) for ICD-10 codes.

[95] See "CPT Category II Coding Tip Sheet," L.A. Care, https://www.lacare.org/sites/default/files/cpt-II-coding-tip-sheet.pdf (last viewed October 14, 2020) and "Obstetrics Coding and Documentation Reference Guide," Blue Cross Blue Shield of Alabama, https://providers.bcbsal.org/portal/documents/10226/306297/Obstetrics+Coding+and+Documentation+Reference+Guide/8f5f1b65-1fd2-49a5-8708-6819a162098e?version=1.0 (last viewed October 14, 2020).

claim lines are excluded from my analysis. These include members with 1) any claims that have both maternal-only and newborn-only codes and 2) any episodes that have mother claims, newborn claims, and claims that could not be explicitly assigned to either the mother or the newborn.

93. Members whose episodes were successfully separated into newborn and maternal sub-episodes are linked with the raw_member_id variable. This variable is the original MEMBER_ID from the data.[96] Each separated newborn who (1) has at least one claim in the data with a birth ICD-9 or ICD-10 diagnosis code (V30-V39 and Z38.0-Z38.9), (2) does not have a claim with a delivery ICD-9 or ICD-10 diagnosis code (V27.0-V27.9 and Z37.0-Z37.9), and (3) has at least one nursery claim (based on nursery revenue codes) is considered in my analysis.

3. Covariates Derived from Claims Data

94. I also use the claims data to construct variables that I include as controls for potential confounding factors in my analyses, including birth characteristics (such as gestational age, birth weight, and C-section or vaginal birth), diagnoses recorded during the episode for the newborn, characteristics of the newborn's mother, and facility resource usage across episodes. In a regression context, variables used to account for potential confounding factors are also known as "covariates" or "controls."

a) Birth Characteristics

95. I identify a newborn's gestational age (extent of prematurity, if any) and birth weight using the diagnosis information recorded on the claims for any of the newborn's episodes. I understand that the recorded diagnoses on a claim for a newborn will typically not include specific age or weight conditions if the newborn is considered to be of "normal" age or weight.[97] To account for this, in the instances where a birth does

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[96] For members that did not have both mother and newborn under the same ID, the raw_member_id is the same as the MEMBER_ID.

[97] I spoke with Dr. Evans over the phone on October 7, 2020 and asked if the absence of a diagnosis for abnormal birth weight was indicative that the newborn had a normal birth weight (similarly for gestational age). Dr. Evans agreed, given the importance of birth weight and gestational age as metrics of newborn health.

not include a diagnosis for either gestational age or weight in the claims data, I assign a value of normal.

96. After I compile these classifications for each newborn, I compare the resulting distribution of ages and weights in the Aetna claims data to the distribution I calculate using data available from the Centers for Disease Control and Prevention ("CDC") covering all privately insured births in the U.S. I show these comparisons below for two separate years in Table 12 (for gestational ages) and Table 13 (for birth weights).[98] As shown in Table 12, I find that the distributions of newborns by gestational age category are similar between the Aetna claims data and CDC's statistics for privately-insured births for both years. Similarly, in Table 13, I find that Aetna's distribution of newborns by birth weight category closely resembles the distribution for privately-insured births in the U.S. according to the CDC.

[98] See National Center for Health Statistics, National Vital Statistics Survey, 2015 & 2018, Public-use birth data files and documentation, https://www.cdc.gov/nchs/data_access/Vitalstatsonline.htm (downloaded on August 27, 2020).

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Table 12: Share of Births by Gestational Age Category

	Aetna Claims		CDC Data	
Gestational Age	Count	Share	Count	Share
2015				
01: Normal	147,201	92.7%	1,704,020	90.0%
02: <24 weeks	161	0.1%	3,480	0.2%
03: 24 weeks	145	0.1%	1,464	0.1%
04: 25-26 weeks	272	0.2%	3,785	0.2%
05: 27-28 weeks	372	0.2%	5,409	0.3%
06: 29-30 weeks	560	0.4%	8,963	0.5%
07: 31-32 weeks	1,031	0.6%	16,414	0.9%
08: 33-34 weeks	2,483	1.6%	39,364	2.1%
09: 35-36 weeks	6,548	4.1%	111,289	5.9%
2018				
01: Normal	125,060	91.9%	1,681,302	89.8%
02: <24 weeks	97	0.1%	3,226	0.2%
03: 24 weeks	85	0.1%	1,382	0.1%
04: 25-26 weeks	182	0.1%	3,476	0.2%
05: 27-28 weeks	269	0.2%	5,266	0.3%
06: 29-30 weeks	418	0.3%	8,519	0.5%
07: 31-32 weeks	798	0.6%	15,847	0.8%
08: 33-34 weeks	2,303	1.7%	39,492	2.1%
09: 35-36 weeks	6,853	5.0%	112,909	6.0%

Notes: CDC Data reflects privately insured births. Normal is defined as a baby whose gestational age is 37 weeks or later. See National Center for Health Statistics, National Vital Statistics Survey, 2015 & 2018, Public-use birth data files and documentation, https://www.cdc.gov/nchs/data_access/Vitalstatsonline.htm (downloaded on August 27, 2020). Aetna distributions are based on Aetna claims data.

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Table 13: Share of Births by Birth Weight Category

	Aetna Claims		CDC Data	
Birth Weight	Count	Share	Count	Share
2015				
1: Normal	148,896	93.8%	1,760,143	92.9%
2: <500g	183	0.1%	2,354	0.1%
3: 500-999g	711	0.4%	8,391	0.4%
4: 1000-1499g	1,138	0.7%	12,293	0.6%
5: 1500-1999g	2,240	1.4%	26,997	1.4%
6: 2000-2499g	5,605	3.5%	84,010	4.4%
2018				
1: Normal	128,271	94.3%	1,738,536	92.9%
2: <500g	77	0.1%	2,146	0.1%
3: 500-999g	448	0.3%	7,791	0.4%
4: 1000-1499g	784	0.6%	11,747	0.6%
5: 1500-1999g	1,798	1.3%	26,417	1.4%
6: 2000-2499g	4,687	3.4%	84,782	4.5%

Notes: CDC Data reflects privately insured births. Normal is defined as a baby whose birth weight is greater than or equal to 2,500 grams. See National Center for Health Statistics, National Vital Statistics Survey, 2015 & 2018, Public-use birth data files and documentation, https://www.cdc.gov/nchs/data_access/Vitalstatsonline htm (downloaded on August 27, 2020). Aetna distributions are based on Aetna claims data.

97. I also construct variables for whether a baby was delivered by Cesarean section ("C-section") and whether a baby was a single birth (rather than twins or multiples) using the diagnosis information recorded on the claims for any of the newborn's episodes.

b) Diagnosis controls

98. I identify a set of diagnosis controls pertaining to newborn health risks in the NICU based on Friedman et al. (2002). Friedman et al. (2002) identified the following 10 categories from the Clinical Classification System (CCS)[99] related to the congenital and perinatal periods: cardiac and circulatory congenital anomalies (213), digestive congenital anomalies (214), genitourinary congenital anomalies (215), nervous system congenital anomalies (216), other congenital anomalies (217), hypoxia (220), respiratory distress syndrome (221), jaundice (222), birth trauma (223), and other

99 "Clinical Classification Software (CCS) for ICD-9-CM," Healthcare Cost and Utilization Project, Agency for Healthcare Research and Quality, https://hcup-us.ahrq.gov/toolssoftware/ccs/ccs.jsp (last viewed on October 10, 2020).

perinatal conditions (224).[100] CCS category 224 is comprised of 181 distinct diagnosis codes. I split this category into 17 distinct diagnosis controls based on the first 3 digits (left of the decimal point) for each code.

99. I identify an alternative set of diagnosis controls as per Phibbs et al. (2007). Phibbs et al. (2007) group congenital anomaly diagnostic risks and associate each with ICD-9 codes.[101]

100. The CCS categories used by Friedman et al. (2002) contain only ICD-9 codes, as do the diagnostic controls derived by Phibbs et al. (2007). ICD-10 codes were implemented beginning in October 2015,[102] and since my analysis extends through 2019, I standardize the ICD-9 codes to ICD-10 using a 2015 crosswalk published by CMS.[103]

c) *Mother's covariates*

101. I identify a set of covariates concerning maternal risk factors by associating diagnosis codes which pertain to the maternal record with the birth episode for that mother's corresponding baby.

102. Xu et al. (2017) identified ICD-9 codes that pertain to a series of maternal risk factors. I utilize these codes to create a set of controls for each risk factor.[104] I convert the ICD-9 codes to ICD-10 utilizing the 2015 crosswalk published by CMS.[105]

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100 Friedman et al (2002) p. 446.

101 Ciaran S. Phibbs et al., "Supplementary Appendix: Level and Volume of Neonatal Intensive Care and Mortality in Very-Low-Birth-Weight Infants," pp. 9-11, https://www.nejm.org/doi/suppl/10.1056/NEJMsa065029/suppl_file/nejm_phibbs_2165sa1.pdf (last viewed October 14, 2020).

102 "ICD-10," Centers for Medicare and Medicaid Services, https://www.cms.gov/Medicare/Coding/ICD10 (last viewed on October 14, 2020).

103 See "2016 General Equivalence Mappings (GEMs) - Diagnosis Codes and Guide," Centers for Medicare and Medicaid Services, October 8, 2012, https://www.cms.gov/Medicare/Coding/ICD10/2016-ICD-10-CM-and-GEMs (last viewed October 14, 2020).

104 There are a few slight differences between Xu et al. (2014) and the maternal covariates in my analysis. For example, I combine "Maternal use of alcohol, drug, anti-infectives, antimetabolic agents, or other noxious substance" and "Maternal tobacco use disorder" into one control variable (has_drug_abuse). See my workpapers for more details.

105 See "2016 General Equivalence Mappings (GEMs) - Diagnosis Codes and Guide," Centers for Medicare and Medicaid Services, October 8, 2012,

103. I link mothers to the corresponding birth episodes of the newborns as follows. First, I isolate the data to only consider members with either delivery or birth codes, but not both. I consider the remaining members having delivery codes to be potential mothers, and the remaining members with birth codes to be potential newborns. I assume that mothers and newborns with distinct MEMBER_IDs and the same SUBSCRIBER_ID are linked to each other. Newborns whose claims are recorded under their mother's MEMBER_ID are linked to the mother with the same raw_member_id.[106]

104. In some instances where multiple mothers have the same SUBSCRIBER_ID, and thus a newborn is linked to multiple mothers, I only consider the linking to be valid if the start date of the delivery episode is up to 3 days before or 1 day after the start date of the corresponding birth episode. I drop any pairings for newborns who still appear to have multiple mothers after this step.

105. Using the linked mother-newborn information, I create a subset of the claims dataset excluding reversals and denied claims for the successfully-linked mothers, up to sixty days before and one day after the start date of the linked birth episode. I then construct the maternal risk factor indicators utilizing the diagnosis information in this claims subset. I associate the resulting mother's covariates with the linked birth episode.

106. I calculate maternal age in two steps. First, I take the number of days between the delivery episode start date and the mother's MEMBER_BIRTH_DATE. If this leads to an age less than 12 or greater than 55, or if the mother's birth date information is not available, I use the maximum MBR_AGE_NBR present in the mother's claim information.[107]

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https://www.cms.gov/Medicare/Coding/ICD10/2016-ICD-10-CM-and-GEMs (last viewed October 14, 2020). In addition, I conducted a review to augment these ICD-10 conversions. For example, I add ICD-10 codes F10 to F19 to 'has_drug_abuse' based on the American Psychological Association classification of substance use disorders, see "Substance use disorders and ICD-10-CM coding," American Psychological Association Services, Inc., September 10, 2015, https://www.apaservices.org/practice/update/2015/09-10/substance-disorders (last viewed October 14, 2020).

106 See Appendix C, Section A.2 above.

107 See "Definitions of Medicare Code Edits," Centers for Medicare and Medicaid Services, March 2012, https://www.cms.gov/Medicare/Coding/ICD10/downloads/icd10_mce27_user_manual.pdf (last viewed on October 14, 2020) for ICD-9 codes, Centers for Medicare and Medicaid Services and

d) Fetal death

107. I identify episodes affected by fetal death or stillbirth and exclude these newborns from my analysis. I utilize diagnosis information on the newborn's record as well as the corresponding maternal record. Phibbs et al. (2007) identify 7 diagnosis codes which may be present on a fetal record and are "incompatible with life."[108] I also find 6 maternal ICD-9 and ICD-10 codes that indicate stillbirth, and use claim information on the maternal record to associate them with the corresponding birth episode.

e) Facility Resource Usage

108. I create facility-resource variables based on a set of revenue codes (REVENUE_CODE) associated with coronary, cardiology, echocardiology, inhalation, operating room, minor operating room, pulmonary, respiratory, and anesthesia services. These revenue codes are suggestive of newborn health conditions involving operations and/or cardiac, respiratory, and pulmonary complications.[109]

109. As a robustness check, I identify an alternate set of facility-resource variables based on the first two digits of the REVENUE_CODE (for example, codes from 250-259 are grouped together, from 260-269, etc.), for revenue codes greater than or equal to 250.[110] I keep variables if they are present in at least 0.1% of episodes with at least one day in the NICU in any year from 2009 to 2019.

"Definitions of Medicare Code Edits v31.0," Centers for Medicare and Medicaid Services, October 2013, https://www.cms.gov/medicare/medicare-fee-for-service-payment/acuteinpatientpps/downloads/fy_14_definition_of-medicare_code_edits_v_31_manual.pdf (last viewed on October 14, 2020) for ICD-10 codes.

108 Ciaran S. Phibbs et al., "Supplementary Appendix: Level and Volume of Neonatal Intensive Care and Mortality in Very-Low-Birth-Weight Infants," p.3, https://www.nejm.org/doi/suppl/10.1056/NEJMsa065029/suppl_file/nejm_phibbs_2165sa1.pdf. (last viewed October 14, 2020)

109 Erika M. Edwards and Jeffrey D. Horbar, "Variation in Use by NICU Types in the United States," *Pediatrics* 142 no. 5 (2018): 3. Studies on NICU admissions and length of stay, such as Edwards and Horbar (2018), have included major surgeries and resuscitation or ventilation-related interventions as "high acuity" conditions for newborns. AAP 2012 Policy Statement, pp. 592-593. In addition, the AAP 2012 Policy Statement discusses ventilation and surgical capabilities as criteria for neonatal levels of care. Therefore, in my main analysis (e.g., Table 5), I include controls for revenue codes for operating rooms, respiratory/pulmonary services, and cardiac services.

110 REVENUE_CODEs below 250 refer to accommodations. See "REVCDn - Revenue code," Healthcare Cost and Utilization Project, Agency for Healthcare Research and Quality, https://www.hcup-us.ahrq.gov/db/vars/siddistnote.jsp?var=revcdn (last viewed on October 15, 2020).

4. E/M Codes Per Diem in the NICU

a) E/M Code Counts in the NICU

110. I limit my analysis to NICU care where the newborn receives level II-IV nursery care or ICU care. I identify NICU levels based on hospital revenue codes (172-174, and 200-209) and then limit to E/M codes billed on the patient-days where level II-IV nursery or ICU codes are observed.

b) Instances When Multiple E/M Codes Are Billed on the Same Calendar Day

111. In some instances, multiple E/M codes may appear on the same calendar day when, as examples, a newborn is transferred to another facility or if the newborn's condition worsens during the day.[111] My analyses focus on the E/M code in the highest severity category on a given calendar day. Focusing on the E/M code in the highest severity category avoids the possibility of creating an imbalance in the total number of E/M codes between Mednax and non-Mednax newborns and also avoids comparing the E/M that were billed on the same day when the newborn's condition may have changed. For these instances, my results would reflect the number of intensive or critical care codes billed in which the newborn was, at some point on each day in the NICU, deemed to require care at those levels.

B. Identification of Mednax Claims

112. I identify all claim lines that have one of the Mednax Tax Identification Numbers (TINs) in the PROVIDER_TIN field and, if applicable, occurred on or after Mednax's acquisition date as Mednax. The list of Mednax TINs consists of all TINs that either (1) appear in one of the two lists provided by Mednax,[112] or (2) appear in the claims data with PAID_PROVIDER_ID matching to a record with "Mednax", "Pediatrix", or "Obstetrix" in the name, or (3) were identified as practice groups acquired by Mednax

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[111] CPT 2019 Professional, pp. 46-48. In addition, there are sometimes multiple codes within the same level of care. In these instances, I select the claim with the higher ALLOWED_AMOUNT value.

[112] MEDNAX01133041 and "2019.03.18 Identification of Practice Groups.pdf" produced by Mednax on March 18, 2019, pursuant to Court Order.

per S&P Capital IQ or online press releases. Steps (2) and (3) result in a small number of additional TINs that I include in the analysis.

C. Additional Data Sources

113. Variables to account for the individual characteristics of a hospital as well as local demographic information are constructed using publicly available sources. They are then mapped to the final sample for regression analyses using the hospital name and address information (for hospital demographics) and the member's zip code (for local characteristics).

1. Hospital Characteristics

114. **Medicare Cost Reports Data**. These data were obtained from the CMS's Healthcare Cost Report Information System (HCRIS) website. I calculate hospital characteristics using the submissions made by hospitals for 2017 – the last year having completed submissions that overlaps with the regression data period. The data I use include reported number of NICU beds and rural status.

115. **Center for Medicare and Medicaid Services (CMS) Open Payments Resources.** I use the annual lists of teaching hospitals accessible through the CMS website.[113]

116. **U.S. News & World Report Rankings for 2020.** The rankings list includes the top 50 hospitals recognized for distinction in neonatology care.[114]

117. **American Academy of Pediatrics (AAP) website data.** I obtain reported NICU levels and number of NICU beds for the state of Texas for use in my Texas case study.[115]

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[113] See "2014 - 2020 Reporting Cycle: Teaching Hospital List[s]," Centers for Medicare and Medicaid Services, https://www.cms.gov/OpenPayments/About/Resources (last viewed September 1, 2020).

[114] See "Best Children's Hospitals: Neonatology," *U.S. News & World Report*, 2020 Best Hospitals Edition, p. 188.

[115] See fn. 90 above.

2. Local Demographic Characteristics

118. **U.S. Census Data at the county level.** I obtain local demographic characteristics including population density, per capita income, percent Black, percent Hispanic, and percent college graduates. I then match these county-level values to the patient's zip code using a crosswalk between county codes (FIPS) and zip codes.

D. Construction of the Regression Sample

119. The top panel of Table 14 summarizes the number of newborns in Aetna's claims data as well as the number who are included in my analyses of E/M coding in the NICU. There were 1.5 million newborn episodes covered by Aetna from January 1, 2009 through February 27, 2019. Approximately 13 percent of these newborns spent one or more days under NICU care during the episode. The majority of these newborns were 28 days or younger at the time of admission to the NICU. When I further require these newborns to have one or more E/M codes billed during the NICU stay, the number of newborns decrease from 191,074 to 173,238, or 11.5 percent of the overall population of newborns covered by Aetna.[116] As discussed in Section V.B, I focus on newborns who have an E/M code on each day in the NICU. These newborns comprise 10.3 percent of all newborns in Aetna's claims data, or 90 percent of newborns with at least one E/M code in the NICU.[117] Furthermore, my main analysis focuses on newborns whose episode began on their date of birth and ended with a discharge code; these newborns comprise 8.6 percent of all newborns in Aetna's claims data or 83 percent of newborns who had an E/M code on each day in the NICU.[118] These newborns who meet the criteria leading up to sample [6] in Table 14 are the primary population whom I study to analyze Mednax's billing behavior.

120. The bottom panel of Table 14 distinguishes newborns under Mednax's care, as defined in Section V.B above. Approximately 71.5 percent of newborns had no E/M codes in the NICU that were affiliated with Mednax ("non-Mednax"). Newborns in the NICU

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[116] Newborns in my final regression sample may not have an E/M code billed on the first or last day during the NICU stay; see fn. 67 above.

[117] 0.90 = 155,976 / 173,238.

[118] 0.83 = 129,478 / 155,976.

under Mednax's care comprised 27.3 percent of the sample ("Mednax").[119] The remaining 1.2 percent of newborns had E/M codes billed by Mednax and non-Mednax entities in the NICU ("Mixed Mednax"). In my main analysis, I focused on newborns who are either Mednax or Non-Mednax, as opposed to Mixed Mednax.[120]

Table 14: Number of Newborns Included in the Regression Analyses

	Sample [A]	# Newborns [B]	% [C]
[1]	All episodes in Aetna's claims data	1,510,356	100.0%
[2]	Sample [1] & at least one day in the NICU	194,030	12.8%
[3]	Sample [2] & <29 days at the time of admission to the NICU	191,074	12.7%
[4]	Sample [3] & newborns with at least one E/M code in the NICU	173,238	11.5%
[5]	Sample [4] & newborns with an E/M code on each day in the NICU	155,976	10.3%
[6]	**Sample [5] & newborns whose episode begins with birth and ends with a discharge code**	**129,478**	**8.6%**
	Breakdown of newborns in the NICU whose episode begins with birth and end with a discharge code		
[7]	**No E/M codes affiliated with Mednax ("Non-Mednax")**	**92,549**	**71.5%**
[8]	**All E/M codes affiliated with Mednax ("Mednax")**	**35,358**	**27.3%**
[9]	Some E/M codes affiliated with Mednax ("Mixed Mednax")	1,571	1.2%
[10]	Total: Newborns whose episode begins with birth and ends with a discharge code	129,478	100.0%

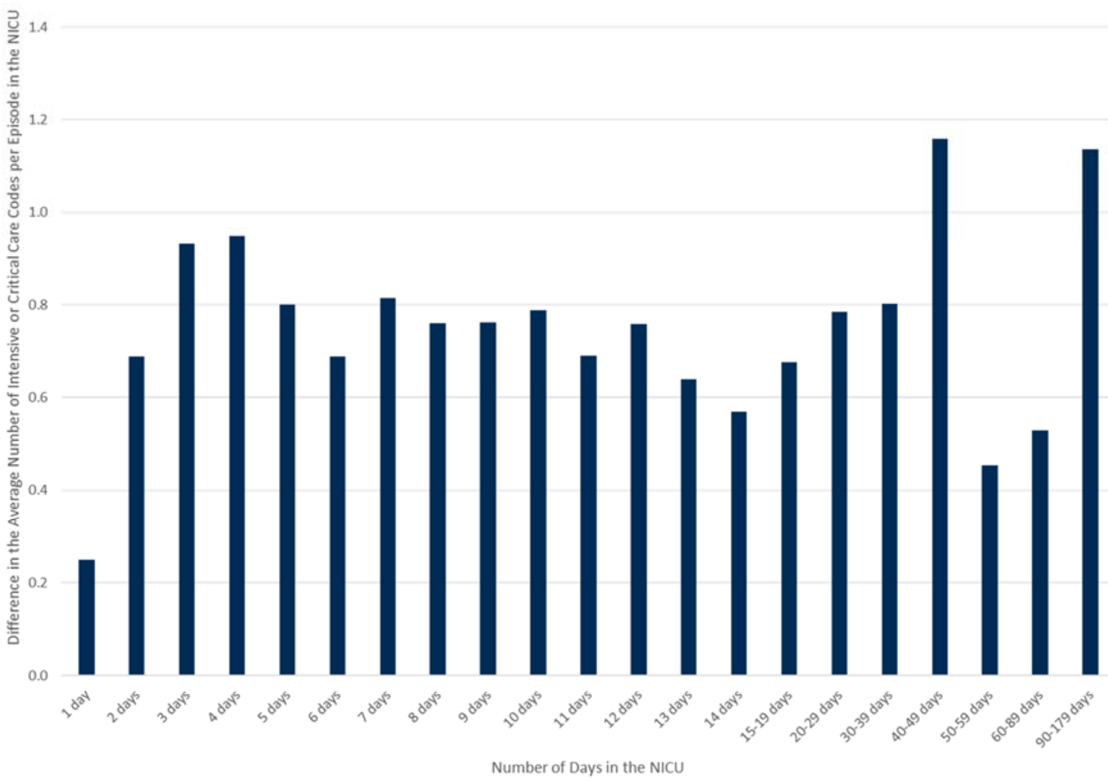
Notes:
- NICU includes level II-IV nurseries and the ICU (revenue codes 172-174 and 200-209).
- E/M codes include newborn, hospital, intensive, and critical care codes; see Table 1.
- Sample [3] excludes newborns with a death-related diagnosis (200 newborns), newborns with episode start dates before the member's birth date (additional 132 newborns), newborns who were ≥29 days when they started receiving care in the NICU (additional 1,722 newborns), and newborns with a CPT code of 99475, 99476, or 99471 at any point during the episode (additional 902 newborns).
- For sample [5], "newborns with an E/M code on each day in the NICU" includes newborns who may not have an E/M code on the first and/or last day in the NICU.
- For sample [6], "newborns whose episode begins with birth and ends with a discharge code" refers to newborns for whom the start date of the episode matches with their birth date and the end date of the episode has a discharge code 99238, 99239, or 99463.

[119] Most episodes have one per diem E/M code billed in the NICU per day. For my discussion about some instances where more than one E/M code is billed on the same calendar day, see ¶ 111 above.

[120] The reason is that, for the non-Mednax and Mednax groups, there is little to no ambiguity as to whether Mednax billed the intensive or critical care codes during the NICU stay. To the extent that the "Mixed Mednax" newborns are different, one would ideally like to separately analyze them; however, given the small sample size, it would be difficult to control for the full range of characteristics that I am able to do for non-Mednax and Mednax newborns.

APPENDIX D – SUPPLEMENTAL DESCRIPTIVE FIGURE

Figure 6: Difference in the Average Number of Intensive or Critical Care Codes per Episode in the NICU by Number of Days in the NICU



Notes: See Section V.D for a full description of the final sample of newborns included in the analysis. The bars represent the difference in the average number of intensive or critical care codes billed in the NICU per episode between Mednax and non-Mednax newborns for newborns who spent the same number of days in the NICU; positive values indicate that Mednax billed more intensive or critical care codes in the NICU. Number of days in the NICU is a count of calendar days in the NICU (revenue codes 172-174 and 200-209).

APPENDIX E – MODELS

A. LINEAR REGRESSION MODEL

121. The linear regression model that estimates the number of additional intensive or critical codes billed in the NICU by Mednax providers is shown below:

Equation 1: Linear Regression Model of Excess Billing of Intensive or Critical Care Codes in the NICU

$$y_{ihst} = \alpha + \beta Mednax_{ihst} + X_{ihst}\theta + Z_{hst}\phi + \delta_{st} + \varepsilon_{ihst},$$

where *i* is an index for newborn, *h* for hospital, *s* for state, and *t* for year when the newborn began to receive care in the NICU.

a. y_{ihst} is the number of intensive or critical care codes billed in the NICU for newborn *i* who began to receive care in the NICU at hospital *h* in state *s* and year *t*.

b. $Mednax_{ihst}$ is an indicator that equals 1 if all E/M codes in the NICU are associated with a Mednax TIN.[121]

c. X_{ihst} is a set of newborn-specific controls. These controls include: birth weight, gestational age, C-section (rather than vaginal delivery), singleton (rather than twin or multiples), sex, age in days when admitted to the NICU, and calendar month when the newborn began to receive care in the NICU. Additional newborn controls include whether the newborn had a transfer, whether the newborn had more than one distinct E/M code on a given day in the NICU, whether the newborn had a NICU relapse during the episode, whether a neonatologist attended the newborn's birth, whether the newborn was resuscitated at birth, newborn health diagnoses based on the CCS classes of problems of birth or the perinatal period (such as congenital anomalies and

[121] See Section V.B above for more details about the construction of the Mednax indicator.

jaundice), and facility resource usage (such as respiratory services or the operating room).[122]

d. Z_{hst} represents hospital controls and local demographic controls.[123] Hospital controls include teaching status, rural status, an indicator if the hospital was not matched to HCRIS, an indicator for any NICU beds in HCRIS, and the number of NICU beds as reported in HCRIS.[124] Local demographic controls include the population density, per capita income, percent Black, percent Hispanic, and percent with a college degree by member zip code and year.

e. δ_{st} are state-year fixed effects that capture state-specific time trends based on the state of the NICU hospital and year when the newborn began to receive care in the NICU.

122. The coefficient on the Mednax indicator (β) measures the average difference in the number of intensive or critical care codes that were billed in the NICU for Mednax newborns compared with non-Mednax newborns after accounting for newborn health risks, hospital controls, local demographic controls, and state-specific time trends. A positive and statistically significant estimate of β indicates that Mednax newborns were, on average, billed more intensive or critical care codes in the NICU than non-Mednax newborns.[125]

123. The model shown in Equation 1 is a fully controlled model, i.e., all potential confounders are included in the model. When I report the results in Table 5 above, I

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122 In addition, I include indicators if the newborn's episode has a revenue code only on the first and/or last days in the NICU. See fn. 67 above.

123 Hospital characteristics include an indicator for any NICU beds (based on the hospital's response to the 2017 Medicare Cost Reports), number of NICU beds as a second-degree polynomial, rural status, and indicator for teaching hospital. Local demographic characteristics are matched to the newborn's zip code and include population density, per capita income, percent black, percent Hispanic, and percent college graduates. Hospital characteristics do not vary across years whereas local demographic characteristics correspond to the year when the newborn was admitted to the NICU.

124 I also include a squared term in the number of NICU beds to allow for non-linearity in the relationship between the size of the NICU and the outcome, such as the number of intensive or critical care codes billed in the NICU.

125 See ¶ 64 and fn. 85 above on statistical significance.

include different sets of controls in each model run (each column shows the results from one model run) to demonstrate how the Mednax differential changes after accounting for different potential confounders.

124. The regression model that I use to analyze the number of days in the NICU has the same form and controls as Equation 1. However, the outcome y_{ihst} is the number of days that newborn i stayed in the NICU rather than the number of intensive or critical care codes billed in the NICU.

125. To analyze the substitution effect, I use the framework in Equation 1 to assess the number of intensive or critical care codes billed in the NICU. In addition to the controls listed in ¶ 121, I also include the number of days in the NICU in the model. In other words, I compare Mednax and non-Mednax newborns who spent the same number of days in the NICU when estimating the average difference in the number of intensive or critical care codes billed in the NICU. This isolated the "substitution effect" because, when comparing newborns who spent the same number of days in the NICU, providers either billed an intensive/critical care code or a newborn/hospital care code. For example, if Mednax billed one additional intensive/critical care code relative to a non-Mednax provider for a newborn who stayed in the NICU for five days, then the non-Mednax provider billed a newborn/hospital care code on a day when Mednax billed an intensive/critical care code.

B. Poisson Count Model

126. I estimate a non-linear count model to test whether the results are driven by modeling assumptions regarding functional form. Count models, including the Poisson model shown in Equation 2, are a standard approach in the economics literature to model counts such as the number of doctor visits per person.[126] The Poisson model that I estimate is presented in Equation 2:

[126] A. Colin Cameron and Pravin K. Trivedi, *Microeconometrics Using Stata, Revised Edition*, (College Station, TX: Stata Press Publication, 2010), Chapter 10.

Equation 2: Poisson Model of Excess Billing of Intensive and Critical Care Codes in the NICU

$$\Pr(y_{ihst}) = \frac{\exp(-\lambda_{ihst})\,\lambda_{ihst}^{y_{ihst}}}{y_{ihst}!},$$

where $\lambda_{ihst} = \exp(\alpha + \beta Mednax_{ihst} + X_{ihst}\theta + Z_{hst}\phi + \delta_{st})$. The indices and variables (y_{ihst}, $Mednax_{ihst}$, X_{ihst}, Z_{hst}, and δ_{st}) are defined in the same way as described above for Equation 1.

127. The results are shown in Table 15.[127] The outcome is shown at the top of each column. Column [1] presents the results of the model analyzing the number of intensive or critical care codes billed in the NICU and estimates the overall difference between Mednax and non-Mednax newborns. Column [2] presents the results of the model analyzing the number of days in the NICU. Column [3] presents the results of the model analyzing the substitution effect, where the outcome is the number of intensive or critical care codes billed in the NICU.

128. Non-linear models, such as the Poisson model, provide an estimate of β, but β does not have the same direct interpretation of a "marginal" or "incremental" effect as it does for the linear model. To calculate the marginal effect, I take the difference in the model prediction that assumes the newborn was cared for by Mednax providers and the model prediction that assumes the newborn was cared for by non-Mednax providers. I report the average marginal effect, which is the average difference in the model predictions across the sample.

129. The results of the Poisson models are consistent with the conclusions from my main analysis in Table 5, Table 6, and Table 7 (see column [5] in each table). The results in column [1] confirm that Mednax newborns were billed more intensive or critical care codes in the NICU than non-Mednax newborns; the estimated number of additional intensive or critical care codes in the NICU is 2.26 per episode. The results in column [2] also show that Mednax newborns had, on average, longer stays in the NICU by 1.60 days. Lastly, the results in column [3] show that Mednax newborns were billed more

[127] I use cluster-robust standard errors, which relaxes the assumption that the variance equals the mean (see Chapters 10.3.2 and 10.4.6 of Cameron and Trivedi (2010)).

intensive or critical care codes in the NICU instead of newborn or critical care codes by 0.68 codes per episode.

Table 15: Results of the Poisson Models

	Overall Difference in Intensive or Critical Care [1]	Number of Days in the NICU [2]	Substitution from Lower to Higher Severity E/M [3]
Mednax Indicator	0.232***	0.149***	0.0694***
	(0.0199)	(0.0156)	(0.00720)
Avg. Difference Between Mednax and Non-Mednax	2.260	1.597	0.677
Number of observations	117081	117081	117081
Number of clusters	1895	1895	1895

Notes: Standard errors in parentheses are clustered by hospital. For these non-linear models to solve (converge), the sample focuses on newborns in states with at least 1 Mednax episode between 2009 and 2019 and excludes 4 states or territories where there were 6 or fewer Mednax episodes throughout the period. The Mednax indicator equals 1 if all E/M codes in the NICU are associated with Mednax. "Avg. Difference Between Mednax and Non-Mednax" is the average marginal effect. The unit of observation is a newborn's episode in the NICU. ***p<0.01 **p<0.05 *p<0.10

C. Logit Regression Models of Coding Patterns

130. To analyze Mednax's coding patterns (see Section IX) and test if the differences between Mednax and non-Mednax providers hold even after accounting for potential confounders, I estimate a logit regression model[128] as shown in Equation 3:

Equation 3: Logit Model of Coding Patterns

$$\Pr(y_{ihst} = 1) = \frac{\exp(\alpha + \beta Mednax_{ihst} + X_{ihst}\theta + Z_{hst}\phi + \delta_{st})}{1 + \exp(\alpha + \beta Mednax_{ihst} + X_{ihst}\theta + Z_{hst}\phi + \delta_{st})}$$

131. The indices in Equation 3 are defined in the same way as described above in Appendix E, Section A.

132. The outcomes y_{ihst} that I analyze include indicators for the newborn's first code in the NICU (such as whether the newborn's first code in the NICU was an intensive care code) and indicators for the subsequent coding pattern conditional on the newborn's first observed E/M code in the NICU (such as whether all E/M codes billed during the

[128] The logit regression model is a standard approach for discrete outcomes, such as whether a homeowner's mortgage application was denied or the newborn's first code in the NICU was an intensive care code; see James H. Stock and Mark W. Watson, *Introduction to Econometrics Third Edition*, (Pearson, 2015), pp. 389-396.

newborn's stay in the NICU were intensive care). For example, for the first code in the NICU, I estimate three models in which the outcomes are: 1 for newborn or hospital care and 0 for all others; 1 for intensive care and 0 for all others; and 1 for critical care and 0 for all others.

133. When I estimate the model to analyze the newborn's first code in the NICU, I control for characteristics that are observed at the time when the newborn began to receive care in the NICU. These controls include: birth weight, gestational age, sex, C-section, singleton birth, age in days when admitted to the NICU, calendar month when admitted to the NICU, whether the newborn had a transfer, whether a neonatologist attended the birth, whether the newborn was resuscitated at birth, and diagnoses based on claims through the date when the newborn began to receive care in the NICU. In addition, I control for hospital characteristics, local demographic characteristics, and state-specific time trends as described in ¶¶ 121.d-121.e above.

134. When I estimate the model to analyze the newborn's subsequent coding pattern in the NICU, I control for the full set of characteristics listed in ¶ 121 as well as the number of days when the newborn was in the NICU. The reason why I control for the number of days in the NICU is to isolate when Mednax billed intensive or critical care codes instead of newborn or hospital care codes. The models of subsequent coding patterns are separately run for groups of newborns who shared the same first E/M code in the NICU.

135. The sample over which I estimate the logit models excludes newborns who spent one day in the NICU. I exclude newborns who spent one day in the NICU because these newborns had a first E/M code but no subsequent E/M codes.

136. The results of the logit models presented in Table 10 and Table 11 show that (1) Mednax newborns in the NICU were more likely to have an intensive care code as the first code in the NICU than non-Mednax newborns and (2) Mednax newborns in the NICU were less likely to have a newborn or hospital care code on their last day in the NICU.

APPENDIX F – ROBUSTNESS TESTS

137. In this appendix, I present the results of my robustness checks for potential alternative explanations of the difference in the number of intensive or critical care codes billed by Mednax relative to non-Mednax providers for newborns in the NICU. Table 16 shows the overall estimated difference in the number of intensive and critical care codes billed in the NICU for Mednax newborns versus non-Mednax newborns. Table 17 shows whether Mednax newborns had, on average, longer stays in the NICU than non-Mednax newborns. Table 18 shows whether Mednax newborns had, on average, more intensive or critical care codes instead of newborn or hospital care codes compared with non-Mednax newborns who stayed the same number of days in the NICU.

138. The three tables share the same structure. Column [1] of Panel A presents the results from the baseline model, which I highlight in Table 5-Table 7 of Section VII.B. Columns [2] through [11] show the results when I change the baseline model to address specific critiques of my analysis. I discuss each change below. Panels B and C of the tables replicate the robustness checks with two alterative comparator groups: non-Mednax newborns in the NICU at hospitals with at least one NICU bed as reported to CMS (Panel B) and non-Mednax newborns in the NICU at one of the top 50 neonatology hospitals according to the U.S. News & World Report (Panel C). The results of the robustness checks consistently show that Mednax newborns in the NICU were billed, on average, more intensive or critical care codes than non-Mednax newborns and that this overall difference is driven by both longer stays in the NICU and substitution towards higher-severity E/M codes.

139. The robustness checks shown in the tables address the following potential alternative explanations:

   a. "Exclude Level II Care Only" (column [2]) and "Include Episodes With Level III or IV on First Day in the NICU" (column [3]) – newborns who receive level II nursery care may see different types of providers than newborns who receive level III or IV nursery care. Relatedly, newborns who receive level III or IV nursery care may have different health risks than newborns who receive level II nursery care. For these tests, I run the analysis after excluding

newborns who did not have a level III or IV nursery claim at any point during their NICU stay (column [2]) and run the analysis focusing on newborns who received level III or IV nursery care on their first day in the NICU (column [3]).

b. "Exclude Transfers, Readmits, and Relapses" (column [4]) – newborns who were transferred, readmitted to the hospital, or readmitted to the NICU before being discharged home ("relapse") may have different coding protocols. For this test, I run the analysis after excluding newborns who were transferred at any point during the episode, readmitted to the hospital to the extent that I am able to discern from Aetna's claims data, or had a NICU relapse during the episode.

c. "Exclude Episodes with Multiple E/M on the Same Day" (column [5]) – in some instances, newborns in the NICU may be billed for multiple E/M codes on the same day. To show that my results are not sensitive to the inclusion of these newborns, I run a test where I exclude newborns who had more than one E/M code billed on the same day.

d. "Add Mother's Covariates" (column [6]) – maternal health risks may contain information about the newborn's health risks that are not fully captured by the newborn's diagnoses. To address this concern, I run my analysis with a rich set of maternal health characteristics based maternal diagnoses identified in peer-reviewed literature.[129]

e. "Use Phibbs Diagnoses Instead of CCS" (column [7]) – to show that my results are not sensitive to the choice of newborn health diagnoses that I include in my main analysis, I run my model including diagnoses based on Phibbs et al. (2007) rather than the CCS categories maintained by the Agency of Healthcare Research and Quality in the U.S. Department of Health and Human Services. The diagnosis controls in Phibbs et al. (2007) have been cited in other peer-reviewed studies, such as Freedman (2016).

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[129] See Appendix C, Section A.3.c.

f. "Use Expanded List of Facility Resource Usage" (column [8]) – I include controls for facility resource usage that may indicate other health risks not captured by my diagnosis controls. Specifically, I focus on facility resources associated with cardiovascular, respiratory, or pulmonary conditions as well as operations. A potential critique is that my controls for facility resource usage may be incomplete. For this robustness check, I include controls for a wide range of facility resources, including lab tests and drugs. The results of this robustness check serves as a conservative estimate because, similar to diagnoses that were inputted while the newborn is in the NICU, the use of facility resources (such as lab tests) may be determined at the same time as the E/M code billed in the NICU.

g. "Include Episodes that Do Not End with a Discharge Code" (column [9]) – as discussed above, my main analysis focuses on newborns whose episode began on the newborn's date of birth and ended with a discharge code.[130] To show that my results are not driven by this decision, I run my analysis across all episodes regardless of whether the episode started with the newborn's birth and ended with a discharge code.

h. "Exclude Episodes with 1 Day in the NICU" (column [10]) – one alternative explanation may be that non-Mednax providers are more likely to have newborns in the NICU for observation purposes than Mednax providers and that the results are driven by a comparison between non-Mednax newborns who may have been observation stays and Mednax newborns in the NICU. To test the influence of potential NICU observation stays on the results, I run the analysis excluding newborns who spent one day in the NICU.

i. "Exclude Episodes with ≥ 60 Days in the NICU" (column [11]) – my analysis focuses on newborns who spent less than 180 days in the NICU to rule out whether newborns with unique circumstances (that are not otherwise being controlled for and that manifest as long stays in the NICU) are primarily

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130 See ¶ 47.d above.

driving my results. To further test the sensitivity of my results to longer stays in the NICU, I run the analysis on newborns who spent less than 60 days in the NICU.

140. Across eleven robustness checks and three comparator groups, I consistently find that Mednax newborns in the NICU were billed, on average, more intensive or critical care codes than non-Mednax newborns. As seen in Table 16, the Mednax differential remains positive and statistically significant across robustness checks and comparator groups. The results in Table 17 also demonstrate that the Mednax differential in the average number of days in the NICU is robust to the potential alternative explanations described in ¶ 139 above. Lastly, the results in Table 18 confirm that Mednax newborns were more likely to be billed for intensive or critical care codes instead of newborn or hospital care codes in the NICU for newborns with the same number of days in the NICU.

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Table 16: Summary of Robustness Tests – Number of Additional Intensive or Critical Care Codes Billed in the NICU

		Changes to the Baseline Model:									
	Baseline Model [1]	Exclude Level II Care Only [2]	Include Episodes With Level III or IV Care on First Day in NICU [3]	Exclude Transfers, Readmits, and Relapses [4]	Exclude Episodes with Multiple E/M on the Same Day [5]	Add Mother's Covariates [6]	Use Phibbs Diagnoses Instead of CCS [7]	Use Expanded List of Facility Resource Usage [8]	Include Episodes that Do Not End with a Discharge Code [9]	Exclude Episodes with 1 Day in the NICU [10]	Exclude Episodes with ≥60 Days in the NICU [11]
Panel A. Comparator Group: All Non-Mednax Newborns Covered by Aetna											
Mednax Differential	1.841***	1.945***	2.138***	1.784***	1.648***	1.827***	1.958***	1.637***	1.804***	1.937***	1.593***
	(0.175)	(0.216)	(0.194)	(0.175)	(0.143)	(0.175)	(0.171)	(0.179)	(0.176)	(0.197)	(0.134)
Number of observations	127578	92628	65350	115572	103618	127578	127578	127578	153705	105055	124232
Number of clusters	2186	1719	1609	2140	2145	2186	2186	2186	2270	2070	2183
Panel B. Comparator Group: Hospitals with NICU Beds as Reported in HCRIS											
Mednax Differential	1.756***	1.834***	2.048***	1.722***	1.514***	1.737***	1.824***	1.509***	1.727***	1.821***	1.488***
	(0.214)	(0.263)	(0.233)	(0.214)	(0.175)	(0.214)	(0.213)	(0.224)	(0.215)	(0.239)	(0.165)
Number of observations	93505	72615	50055	84137	74868	93505	93505	93505	112635	78976	90624
Number of clusters	1088	984	944	1070	1066	1088	1088	1088	1105	1067	1086
Panel C. Comparator Group: Top Ranked Neonatology Hospitals											
Mednax Differential	2.524***	2.681***	2.975***	2.651***	2.067***	2.499***	2.278***	2.109***	2.410***	2.698***	1.888***
	(0.399)	(0.430)	(0.424)	(0.389)	(0.277)	(0.401)	(0.424)	(0.366)	(0.420)	(0.442)	(0.273)
Number of observations	43877	36255	23560	37640	33628	43877	43877	43877	50024	39559	42027
Number of clusters	552	480	448	533	532	552	552	552	563	542	549

Notes: Standard errors in parentheses are clustered by hospital. *** p<0.01, ** p<0.05, * p<0.10. (Continued on next page)

Notes (continued):
- NICU is defined by revenue codes 172-174 and 200-209.
- E/M includes per diem newborn, hospital, intensive, and critical care CPT codes as shown in Table 1.
- The outcome is the number of intensive or critical care codes billed in the NICU.
- "Mednax Differential" equals 1 if all E/M codes in the NICU are associated with a Mednax tax identifier (TIN).
- The comparator group in Panel A includes all newborns in the NICU cared for by non-Mednax providers who meet the criteria for the final sample (see Section V.D) in Aetna's claims dataset. The comparator group in Panel B includes newborns cared for by non-Mednax providers at hospitals with at least one NICU bed as reported to the 2017 CMS HCRIS. The comparator group in Panel C includes newborns cared for by non-Mednax providers at the top 50 neonatology hospitals according to the 2020 U.S. News & World Report rankings.
- See Appendix E, Section A for a complete list of controls.

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Table 17: Summary of Robustness Tests – Number of Additional Days in the NICU

		Changes to the Baseline Model:									
	Baseline Model [1]	Exclude Level II Care Only [2]	Include Episodes With Level III or IV Care on First Day in NICU [3]	Exclude Transfers, Readmits, and Relapses [4]	Exclude Episodes with Multiple E/M on the Same Day [5]	Add Mother's Covariates [6]	Use Phibbs Diagnoses Instead of CCS [7]	Use Expanded List of Facility Resource Usage [8]	Include Episodes that Do Not End with a Discharge Code [9]	Exclude Episodes with 1 Day in the NICU [10]	Exclude Episodes with ≥60 Days in the NICU [11]
Panel A. Comparator Group: All Non-Mednax Newborns Covered by Aetna											
Mednax Differential	1.308***	1.485***	1.596***	1.257***	1.136***	1.293***	1.404***	1.125***	1.306***	1.354***	1.049***
	(0.151)	(0.190)	(0.185)	(0.148)	(0.117)	(0.151)	(0.149)	(0.155)	(0.154)	(0.171)	(0.107)
Number of observations	127578	92628	65350	115572	103618	127578	127578	127578	153705	105055	124232
Number of clusters	2186	1719	1609	2140	2145	2186	2186	2186	2270	2070	2183
Panel B. Comparator Group: Hospitals with NICU Beds as Reported in HCRIS											
Mednax Differential	1.343***	1.533***	1.641***	1.321***	1.126***	1.324***	1.392***	1.120***	1.332***	1.380***	1.065***
	(0.180)	(0.225)	(0.220)	(0.174)	(0.139)	(0.181)	(0.182)	(0.192)	(0.185)	(0.204)	(0.128)
Number of observations	93505	72615	50055	84137	74868	93505	93505	93505	112635	78976	90624
Number of clusters	1088	984	944	1070	1066	1088	1088	1088	1105	1067	1086
Panel C. Comparator Group: Top Ranked Neonatology Hospitals											
Mednax Differential	1.945***	2.047***	2.231***	2.026***	1.527***	1.921***	1.719***	1.583***	1.907***	2.090***	1.265***
	(0.418)	(0.438)	(0.428)	(0.413)	(0.280)	(0.419)	(0.451)	(0.389)	(0.420)	(0.456)	(0.279)
Number of observations	43877	36255	23560	37640	33628	43877	43877	43877	50024	39559	42027
Number of clusters	552	480	448	533	532	552	552	552	563	542	549

Notes: Standard errors in parentheses are clustered by hospital. See Notes to Table 16 above. The outcome is the number of calendar days in the NICU (revenue codes 172-174 and 200-209).
*** p<0.01, ** p<0.05, * p<0.10.

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Table 18: Summary of Robustness Tests – Substitution from Newborn or Hospital Care to Intensive or Critical Care E/M Codes in the NICU

		Changes to the Baseline Model:									
	Baseline Model [1]	Exclude Level II Care Only [2]	Include Episodes With Level III or IV Care on First Day in NICU [3]	Exclude Transfers, Readmits, and Relapses [4]	Exclude Episodes with Multiple E/M on the Same Day [5]	Add Mother's Covariates [6]	Use Phibbs Diagnoses Instead of CCS [7]	Use Expanded List of Facility Resource Usage [8]	Include Episodes that Do Not End with a Discharge Code [9]	Exclude Episodes with 1 Day in the NICU [10]	Exclude Episodes with ≥60 Days in the NICU [11]
Panel A. Comparator Group: All Non-Mednax Newborns Covered by Aetna											
Mednax Differential	0.596***	0.530***	0.620***	0.584***	0.557***	0.596***	0.611***	0.575***	0.546***	0.641***	0.579***
	(0.0738)	(0.0856)	(0.0729)	(0.0770)	(0.0627)	(0.0738)	(0.0719)	(0.0761)	(0.0659)	(0.0820)	(0.0634)
Number of observations	127578	92628	65350	115572	103618	127578	127578	127578	153705	105055	124232
Number of clusters	2186	1719	1609	2140	2145	2186	2186	2186	2270	2070	2183
Panel B. Comparator Group: Hospitals with NICU Beds as Reported in HCRIS											
Mednax Differential	0.454***	0.357***	0.448***	0.441***	0.405***	0.452***	0.463***	0.428***	0.422***	0.479***	0.435***
	(0.0913)	(0.103)	(0.0885)	(0.0966)	(0.0746)	(0.0912)	(0.0889)	(0.0925)	(0.0806)	(0.0996)	(0.0766)
Number of observations	93505	72615	50055	84137	74868	93505	93505	93505	112635	78976	90624
Number of clusters	1088	984	944	1070	1066	1088	1088	1088	1105	1067	1086
Panel C. Comparator Group: Top Ranked Neonatology Hospitals											
Mednax Differential	0.745***	0.817***	0.925***	0.778***	0.543***	0.740***	0.706***	0.679***	0.632***	0.805***	0.622***
	(0.154)	(0.164)	(0.170)	(0.204)	(0.170)	(0.155)	(0.152)	(0.140)	(0.128)	(0.175)	(0.137)
Number of observations	43877	36255	23560	37640	33628	43877	43877	43877	50024	39559	42027
Number of clusters	552	480	448	533	532	552	552	552	563	542	549

Notes: Standard errors in parentheses are clustered by hospital. See Notes to Table 16 above. The outcome is the number of intensive or critical care codes billed in the NICU. The results shown in the table are based on models that control for the number of days in the NICU. *** p<0.01, ** p<0.05, * p<0.10